AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 10, No. 46 WEEKLY. | NEW YORK, NOVEMBER 12, 1887. | $2.50 per Annum. SINGLE COPIES, 5 CENTS.

COPYRIGHT 1887, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Thone Electric Motor.

With this we present an illustration of a new electric motor, which seems to possess exceptional merit in the points of simplicity, economy of space, certainty and closeness of regulation and neatness of design and appearance.

As will be seen from the engraving, the armature is of the disk type, and revolves in a two pole field, the coils being connected to a commutator of the ordinary type. The field magnet coils connect as a shunt to the armature; hence the machine is self regulating. This is a radical departure from the usual practice, and removes the necessity for centrifugal governors, or methods of governing the speed by the shifting of the brushes, or the employment of resistance boxes (rheostats), and maintains a constant speed under great variations of load. A simple switch is provided, by means of which it may be thrown into circuit without danger, especially where a constant potential circuit is used. By this device also all danger to the motor itself, in starting, is avoided, the inertia being gradually overcome as it is brought up to full speed.

The machine is compact and of neat design, every detail having evidently been well considered. The pulley on which the belt runs is on the outer end of the armature axis, opposite the commutator.

They are built in sizes ranging from one-half to ten horse power (smaller or larger to order), and for high or low tension currents as desired. Those up to four horse-power are adapted to currents ranging from 50 to 110 volts, and the larger sizes for currents of from 110 to 220 volts.

It is claimed for these motors that they possess many advantages over other means of developing small power, such as in the points of economy of space, absence of noise and dirt, and in economy.

It is well known that large engines of modern construction develop power far more economically than can be done by small engines, and in transforming this power into electricity by a good generator, conducting it to the various points at which it is to be used on copper wires, and again transforming it into motive power by such motors, the percentage of loss by transformations and conduction is considerably less than the difference in economy between large engines of approved construction and the small ones generally used for such purposes, thus giving the electric motor the advantage in point of economy over small engines, as now built. This fact is of considerable interest to owners of electric lighting plants, as it enables them to use their machinery for the development of motive power during the day when not needed for lighting.

These motors are built by the Hawkeye Electric Manufacturing Company, of Oskaloosa, Iowa, who have an office at 94 Liberty Street, New York.

THE THONE ELECTRIC MOTOR.

In March last an inquiry was made among the working people of the city of London, in regard to their condition. 30,000 blank cards were filled by working people, answering questions regarding their occupation, income, expenses, etc. From this it appears that the average of weekly incomes is 24s. 7d., about $6, and of this about 25 per cent., is paid for rent.

It is reported that Colonel McClausland, of Temple, Texas, has sold one-half interest in a machine for washing dishes for $150,000.

Universal Radial Drilling Machine.

With this we illustrate the latest pattern of radial drilling machines, as made by the Niles Tool Works, Hamilton, Ohio. This type of machine has been built by the firm named for some years, and the one shown represents the more recent improvements.

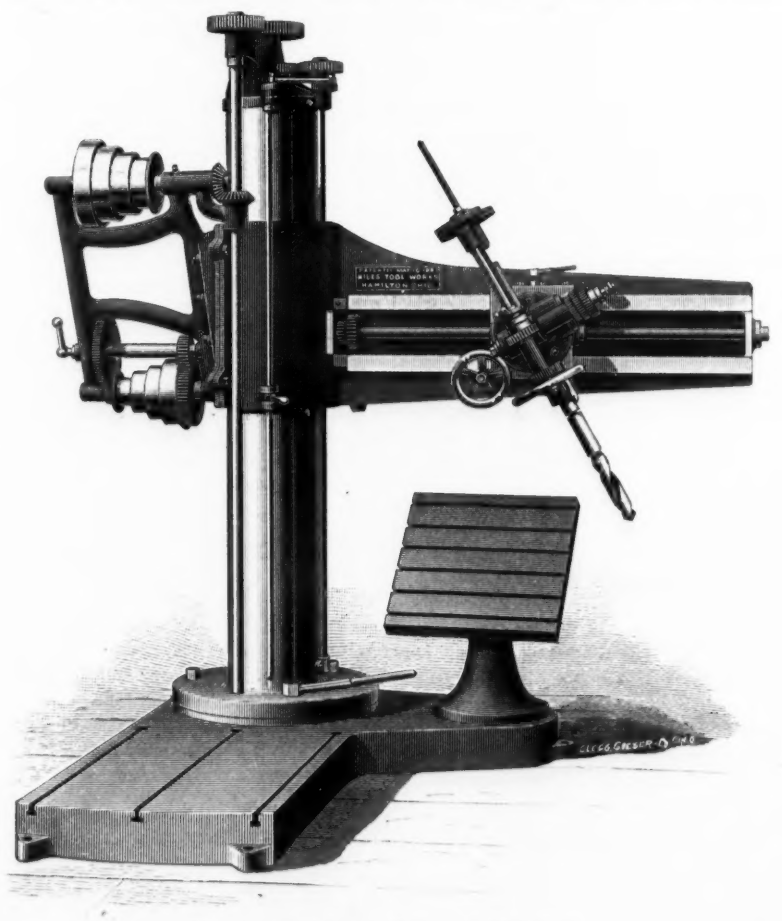
Care has been taken in the design of this machine to secure stiffness in the arm, that is, to reduce the deflection to a minimum. The arm is in form similar to a box girder. It is in one piece, the sleeve surrounding the column forming part of it; a heavy web on the upper side resists the upward strain.

The column is set upon rollers in the base, enabling the operator to handle the machine with ease. It can be very readily moved to position to bring the drill point to the desired location.

The drill head is so made as to be in very exact balance. The bolts may be loosened at any time without endangering the machine or operator. The drill is back geared, giving eight changes of speed; power feed with three changes is provided.

The engraving may be taken to represent either of the two sizes in which the tool is made. The No. 1 size has arm 5 feet long and column 7 feet 4 inches high. The greatest distance from sole plate to end of spindle is 5 feet 3 inches; greatest distance from center of column to spindle with drill head at extreme end of arm is 4 feet 6 inches.

The No. 2 has arm 6 feet long and column 8 feet 3 inches high. The greatest distance from sole plate to end of spindle is 5 feet 7 inches; greatest distance from center of column to spindle with drill head at extreme end of arm is 5 feet 7 inches.



UNIVERSAL RADIAL DRILLING MACHINE.

It is doubtful if there is a large city in the world in which the streets are kept in so demoralized a condition by companies and corporations as they are in New York. They tear up pavement and dig and burrow at their will. Notwithstanding the assertion of health officers to the contrary, ordinary mortals will continue to believe that the intolerable stench from trenches left open without limit as to time breeds disease. A half dozen companies—more or less—appear to do just as they please in the matter of tearing up and blockading streets, but if a private individual obstructs a street by as much as an inch or two he pays the penalty without delay. There is something wrong in the matter if it is a fact, as it appears to be, that the law can be enforced against the individual but is powerless against corporations.

The Exhaust Injector.

BY W. H. BOOTH.

Though the injector has been so long in use, and is known to all engineers and users of steam, there are really very few who comprehend its action, and men who will explain and clearly understand the principles upon which steam, working through the medium of a pump, is able to force water into a boiler against steam of a higher pressure than that which actuates the pump are quite incapable of comprehending the *modus operandi* of the injector, which, therefore, is still a sealed book to very many. If this is the case with the ordinary, or, as it is now often termed, the "live" steam injector, how much more so must it be the case with the exhaust steam instrument which will force water into a boiler when at 70 pounds gauge pressure, and at the same time is merely drawing its own working steam from an exhaust pipe the end of which is freely open to the atmosphere, and in which the steam, as it escapes, is so little above the atmosphere that it may be said to be simply at that pressure. Properly examined, there is no mystery in the matter at all, nor is there any need of employing mathematics of a high order to clearly explain its action, though, so far as has yet been written, I know of no simple statement in plain figures showing the action of what is, after all, the simplest form of steam engine with which we are acquainted.

To illustrate the subject we will suppose an actual case, and work out what we ought theoretically to expect from an exhaust injector in the way of forcing water against the pressure in a boiler.

First, what are our data? We have a supply of steam at atmospheric pressure or 0 pounds by the gauge, and we will suppose

that our supply of water comes to us at 70° Fahr. Then the steam temperature corresponding to atmospheric pressure is, of course, 212° Fahr.; and we know by practical experience that we can feed water into a boiler at 190° Fahr. We will therefore take 190° as the feed temperature, that is to say, the rise in temperature of the water is 190° — 70°, or 120° Fahr. Looking upon the injector as a heat engine, by the laws of thermo-dynamics we should have an efficiency of

$$\frac{t_1 - t_2}{t_1 + 461.2}$$

or

$$\frac{212 - 190}{212 + 461.2} = \frac{220}{6732} \text{ or } 0.0327$$

but little over 3 per cent. of the total work in the steam used; but we will not follow out this method of reasoning, but confine ourselves to a plainer statement of the action of the instrument, which can be understood by any who can use the first three rules of arithmetic.

Experiment has shown that steam will flow into a vacuum or into a partial vacuum with a velocity dependent upon the difference between the pressures of the vessels between which the flow takes place. In the exhaust injector we have first steam at 212°, which has a pressure of 14.7 pounds per square inch, or say 30 inches of mercury. We next have the vessel into which the steam flows. Clearly this is the combining nozzle of the injector at a temperature of 190°, equivalent to 19 inches of mercury. We will call these two pressures P and p respectively. The density of mercury as compared with water is 13.6. This we will call D. The density of steam at 212° is similarly .00060826, and this we will call d. Now careful experiment and reasoning has shown that the rate of flow in feet per second with which steam will pass between two vessels may be expressed by the formula

$$V = \sqrt{\frac{64.4\,[P - p]\,D}{12\,d}}$$

or more simply

$$V = 29.6\sqrt{\frac{P - p}{12\,d}}$$

For our particular case, knowing d P and p, we have simply

$$V = 1200\sqrt{\frac{P - p}{12}}$$

or 1200 × .957 = 1148.4 feet per second. This is to say that if a partial vacuum equal to 11 inches of mercury exist in one vessel, steam will rush into it at the speed of 1,148 feet per second, from a simple open-topped boiler. This velocity is very great, being nearly 800 miles per hour. Here, then, we have our working factor—a jet of steam, traveling at 1,148 feet per second. This jet becomes condensed by contact with the feed-water, and is so reduced to very small bulk, but still preserves its great velocity. It has now to perform work, having attained this high velocity by a change of temperature; that is, by losing 22 degrees in temperature, it has acquired another kind of energy—the energy of motion—and this it is that must now be utilized to perform work. If we turn to works on hydraulics, we may find that, similarly, to make this investigation short, water issues from an orifice, with a velocity in feet per second =

$$V = 12.19\sqrt{P}$$

where P is the pressure in pounds per square inch, within the vessel from which the water flows. We will suppose that the boiler pressure in our present case is 70 lbs. by the gauge, so that the total difference of pressure between the boiler and the combining cone of the injector is 75 lbs. Thus $V = 12.19 \times 8.66 = 105{\cdot}5$ feet per second, against which the injector has to work. In other words, there is an opening in the boiler out of which water is rushing with a speed of 105½ feet per second; and we require to overcome this jet by means of another jet, which must clearly have a velocity greater than 105½ feet, or it will not drive back the issuing jet. It has been stated that, of the water entering a boiler, one-eighth, when forced in by the exhaust injector, consists of the condensed exhaust steam, the remaining seven-eighths being water. This being the case, let us admit, and we have a jet of steam at 1,148 feet speed, carrying with it seven times its weight in water. Under these circumstances we should expect that the combined jets would only have one-eighth the velocity of the steam, for the water supply flows simply slowly into the instrument. One-eighth of 1,148 is 143½, and this is the final jet velocity, whose duty it is to overcome the outflow from the boiler at 105½ feet. Let us allow 25 per cent. for loss by eddies and friction in the nozzles, and we are still left with a velocity of 107½ feet to combat a jet of 105½. Clearly the injector is the better, and will feed our boiler at 70 lb. gauge pressure, with ease, under the conditions laid down; and with this view of its action it is not difficult to comprehend its working. Let us now see if the proportion of steam of one-eighth is compatible with known facts.

We have 7 pounds of water, raised from 70° to 190°. This will require 120×7 =840 thermal units. [More truly, 844 units.]

One pound of steam at 212° contains 1178.6 thermal units. The same at 190°, *i. e.*, when reduced to water, contains 190.6. In thus changing to water our pound of steam has given up 1178.6—190.6=988 thermal units, but we have only absorbed 844 by our 7 pounds of water. We are therefore driven to conclude that some item in our assumptions needs changing. First, if the proportions of steam and water be unchanged we should require a colder feed. With a feed supply of 60°, for example, we should absorb heat to the extent of 130 × 7 = 910. With 50° temperature we should absorb 980 units, and so may conclude that in this case we should need colder water to fulfill the other conditions. Secondly, we might put in our feed at more than 190°. If at 200° our 7 pounds of water would absorb 130° × 7 = 910 units, and our pound of steam would give up 978 units; at 205° the water would absorb 945 units and the steam would give up 973 units; but at 205° the rapidity of steam flow would be much reduced, being only 600 feet per second by the formula given above; so we may conclude that the injector would not work in this second case at all. Finally we may suppose the amount of steam consumed to be only ⅛ of the total jet, and we have then one pound of steam losing 988 units and 8 pounds of water gaining 120 × 8 = 960 units. Here we have a very close correspondence, and as we have a final jet velocity of 1148 ÷ 9 = 127 feet per second, or still a large margin for frictional resistance, we may conclude that with water supply a little under 70°, and a final temperature of 190°, we could feed readily into a boiler at a gauge pressure of 70 pounds, and consume exhaust steam to the extent of 1 pound for every 9 pounds of feed. With colder water supply of course we may expect the best results; but a few simple figures have here served to show that the exhaust injector is a remarkably efficient machine under its conditions of working, and may be expected to perform just about what our figures show to be its practical limits, and which experience has proved are such.

English Standard Pipe Threads.

With a view to answering some inquiries, we asked information upon the above subject from Geo. W. Bond, Manager gauge department of the Pratt & Whitney Co. The committee to which Mr. Bond refers is the committee of the American Society of Mechanical Engineers. He writes:

Our committee work did not include the consideration of English practice in pipe threads, hence we did not go into it fully; but from all the data I have been able to obtain, it seems that the standard if there is any there, is 11 threads for all sizes one inch and upwards to 4 inches, both sizes included, (11 threads per inch).

I have not seen any trade list which includes sizes over 4 inches inside diameter, English manufacture, but will look into the matter further, and will be pleased to advise you if I find that there is a standard for the sizes above 4 inches for the pitches of the threads.

The thickness of pipe, as shown in the lists I have seen, would preclude the use of 8 threads per inch, being somewhat thinner, and no doubt all are cut with a straight thread, no taper, as in the Briggs standard.

Time to Quit.

If the Pullman Palace Car Company cleared a million and a half dollars last year, it is time the public should demand that they pay their porters enough to enable them to live without depending on fees. The porters earn a certain amount of money. If that money is given them by their employers, it is wages; if by passengers, it is charity. The present system forces the porters into the attitude of beggars, while the passengers are actually giving their alms to the millionaires of the car company, instead of the porters. A very considerable portion of the million and a half net profit is the charity of patrons of the cars who have paid liberally in fares for all the service they have had. Let the public refuse to pay fees; then the company will pay its own employes, and the porters, while receiving equally as good remuneration, will not be compelled to solicit charity. — *Telegram-Herald (Grand Rapids, Mich.)*

A New Water Wheel.

The cut shows a new form of water wheel, brought out by Craig Ridgway & Son, Coatesville, Pa.

The wheel proper is made up of two wheels, one discharging downwards and the other upwards. When the gate is half drawn the lower wheel only receives the water, and having its buckets filled runs to full speed and develops its full percentage of power, which is said to vary from 80 to 85 per cent. The gate consists of a flat plate, which slides over rectangular openings, admitting water to one or both wheels as may be desired.

By this construction, the builders claim that a practically uniform rate of efficiency is obtained at all gate openings, any slight variation existing being in favor of the smaller opening.

B. B. Bunnell, of Bradford, Conn., has invented an automatic lamp which goes by clockwork. When the right hour comes a cap is drawn over the wick, leaving a small blaze; the cap is lifted when the lamp is needed again. Several of these are in use in the streets of New London, and go without any care for several days, a large tank of oil supplying them.

A paper, most interesting to brickmakers, in regard to the burning and drying of brick with natural gas, was read before the National Brickmakers' Association at its second day's session, by Mr. D. C. Cawley, of Pittsburg. Mr. Cawley said that since the introduction of natural gas into Pittsburg for manufacturing purposes, so successful had the experiments been with nature's great gift in burning brick, that the majority of the brickmakers in the Smoky City were now using that fuel.

"The march of progress is shown by the following statement: "It is now possible to construct a complete sewing machine in a minute, or sixty in one hour; a reaper every fifteen minutes or less; 300 watches in a day, complete in all their appointments. More important than this even is the fact that it is possible to construct a locomotive in a day. From the plans of a draftsman to the execution of them by the workmen, every wheel, lever, valve and rod may be constructed from the metal to the engine intact. Every rivet may be driven in the boiler, every tube in the tube sheets, and from the smokestack to the ash-pan a locomotive may be turned out in a working day, completely equipped, ready to do the work of 100 horses."

There are other things beside "the march of progress" shown by the above, which we clip from the *Philadelphia Record*. One of these is the proneness of the newspaper men to become badly "mixed" on items pertaining to mechanical matters. The statement is entirely misleading, because, as a matter of fact, no such feats of manufacturing can be performed. Turning out sewing machines at the rate of one per minute is one thing, and building a machine complete in one day is quite another thing. The one is quite possible, the other quite impossible.

There are shops where locomotives can be turned out at the *rate* of over one per day, but there is not now, and there never will be, a shop where the plans of a locomotive, and the machine itself can be completed in a single day.

Fair of the American Institute.

The fifty-sixth annual exhibition of this Institute, although open for some weeks, lacks in many particulars of being complete. It is a fault of exhibitors, as it is every year, that they are slow in placing their exhibits. The electrical part of the exhibits is likely to be disappointing to the casual observer, although those who are inclined to go patiently through the devices shown will find much to interest them. To the mechanic who sees nothing remarkable in moving a car by electricity, or in revolving car wheels clear of the track, the most interesting thing in electricity will doubtless be the excellent work done by the Sprague motor. The exhibitors of this motor have shown rare sense in placing it in different parts of the building doing actual and hard work, such as driving elevators, fans, electric lights, printing presses, etc., and it is making a good impression upon all who observe it critically. It runs with excellent regularity under changes of load. We have no means of coming at the cost of operating this motor, but judging by its convenience, and the way it does its work, there must be a large place for it in industries where the power used is small. It appears to be a thoroughly practical machine, with nothing of a "show" feature about it.

The exhibit of steam engines shows nothing particularly new, but there are several examples of good modern practice that will pay the trouble of investigation. An example of belting to dynamos by over-riding belts, in the instance of the Ball engine, is noteworthy.

The display of steam pumps is so far small. A medium sized pump by Smith and Vaile, of New York, appears to do good work.

A. C. Manning & Co., of New York, show several Otto gas engines, one of them driving a dynamo for electric lighting. As usual, these engines work admirably.

The Economic Gas Engine Co., New York, also show several small motors.

The Baldwin gas engine, as shown by the Otis Elevator Co., of Yonkers, N. Y., is driving a dynamo for electric light very satisfactory.

In foundry work, T. Shriver & Co., New York, show some good examples of fine and

intricate castings. It would be hard to excel some of the core work shown by this firm, as well as some of the work showing exact reproduction of the fine forms of pattern.

The Continental Iron Works, Brooklyn, N. Y., exhibit some very fine examples of steel welded work, such as receivers, large cylinders of thin metal, corrugated furnace flues, etc. Their exhibit is sure to attract the attention of mechanics, and is creditable in every way.

E. Gould & Eberhardt, Newark, N. J., have an exhibit of machine tools, comprising their improved upright drill, shaping machines, hand lathes with slide rests, automatic gear cutter, etc. The machines shown are good examples of their kind, and attract attention.

Mending Broken Castings.

BY ROBERT E. MASTERS.

Duplicate rolls for special work are not always kept on hand to replace those that may be broken, in the middle of a hurried order. Whether the roll is large or small, after all the time and labor of moulding, casting, turning and fitting has been expended, it is a matter of great economy to burn on a piece that has been broken out. As an example, I show the mending of a broken groove in a 12,000 pound roll.

A cast-iron frame or cope, with notches in each end to fit between the grooves, is rammed up with a dry sand mixture; we keep several of these cast-iron frames, of various sizes, to be used especially for this purpose. There is nothing particular about the fit, as, with the help of a few gaggers, the sand can be lifted out from the grooves; but if we have none that is suitable, we take a half of a light cast-iron flask and break it out to suit the special work. Wooden ones will burn up, and even if that is guarded against they are not as cheap in the end nor as safe and reliable as iron frames.

After the cope is rammed up and lifted off, the sand above the impression of the break is cut out the width of the base of the groove, and 1″ longer at each end of the impression than the length of the break. Sometimes a block of wood is got out to cover the break and extend to the top of the flask, to save the time of cutting through the sand; but there is really nothing gained by this, as it takes as long to get out the block as it does to cut through the sand.

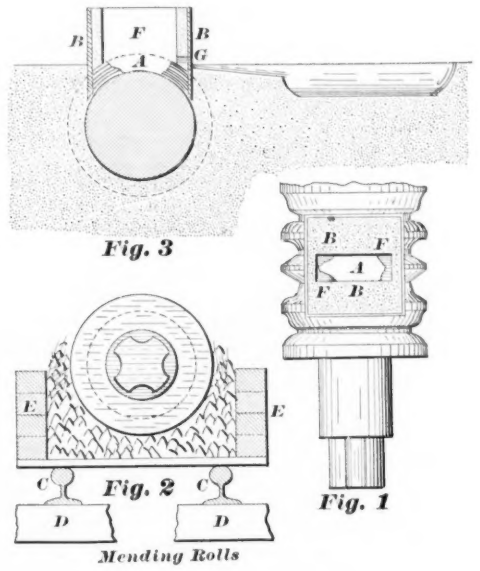
Fig. 1 is a top view of the flask and part of the roll, showing the break *A*, and the opening cut through the flask *B B*, to receive the iron. After this mould has been dressed and blackwashed it is dried on the floor.

The frame, Fig. 2, to heat a roll of this size, is an improvised affair of two rails, *C C*, resting on the cast-iron weights, *D D*; bars of any kind, just so they are heavy enough to support the weight, are laid on the rails to answer for a grate. A loose brick wall, *E E*, is built around the edge of this, to hold the coal, and the fire started; the roll is laid in, the necks resting on iron slabs laid on the wall at each end (not shown in drawing).

It is not expected to heat this roll red hot only at that portion surrounding the break. The roll is then lifted into a trench dug in the floor, and the cope *B* fitted on as in section, Fig. 3. The shape of the groove prevents the cope from shifting sidewise, and one can look down through the hole *F*, and divide the space at each end of the break. Put a weight on top of the cope and tuck the sand around the roll and bottom of the flask.

A ladle of good fluid iron is now started in on the broken place, and the stream kept moving back and forth, the iron escaping through the opening *G* into pig beds. We do so much of this work that we keep on hand a lot of light boiler plate to lay over the pig beds, and cover the plates over with sand, before the pouring commences; this makes it pleasanter for the men around the work, especially in hot weather. As soon as the iron has cut into the roll enough to be thoroughly united, the escape *G* is stopped up, and the head *F* filled up about 4″ above the roll, to give a good solid groove.

To give those who are unacquainted with this class of work, as an idea of the cost and the length of time taken to do it, I will relate the following: One day last week a fish bar roll, weighing 5,000 pounds, and which cost considerable money to fit up after it was cast, was brought into the foundry at 10 A. M., to be mended "at once." The break was 7″ long, 2½″ wide. Two moulders and a helper were put on the work, and at 4 P. M. the piece was burned on; the next morning the roll turner had it in his lathe and dressed it up that day. This piece was burned in by running through about 400 lbs. of iron. We have the advantage of being able to get fluid iron at most any time through the day, from one or the other of our several foundries, but we never use anything but charcoal iron in rolls.



MENDING BROKEN CASTINGS.

A fearful state of affairs is revealed by a recent dispatch to *The World* from Vienna. Upon inquiry it was found that four thousand children attending the schools of that city were suffering from hunger; some of them being on the verge of starvation. They were found to be mostly the children of laboring men, and the revelation of their condition and sufferings has roused the active sympathy of the citizens, and a movement, charitable in its nature, has been set on foot for their relief. We fear, however, that it will be found that the final remedy for such conditions must go much deeper than charity.

It is now proposed to do away with the use of explosives in mines where their use is attended with danger, and substitute a cartridge, one portion of which is filled with a mixture of finely divided zinc and zinc oxide, which collects in the condensers of the zinc retort, while the other part is filled with dilute sulphuric acid. This cartridge is to be put in place as usual, and then, by suitable mechanism, the acid allowed to flow into the zinc. Hydrogen is then evolved, and by its expansive force the rock is broken down, without combustion or violent explosion.

The mills and manufactories at Augusta, Ga., are largely supplied with power from the canal owned by the city. The price paid is $5.50 per horse-power per year.

It is said that Augusta, Ga., is the largest manufacturing center for brown goods in the United States.

New Positive Blast Blower.

The illustrations given on this page show a new positive blast blower which possesses some points of interest, though the principle upon which it is constructed has previously been applied to other uses.

In the sectional view, Fig. 1, the arrangement of the parts is shown. The inner cylinder is eccentric to the outer case, and, in slots provided for the purpose, carries four plates or blades made of lignum vitæ, which are pressed out against the inner surface of the case by the square springs shown in contact with their inner edges. There are two of these springs, one at each end of the cylinder. They are made of a flat band of steel, formed in the manner shown, and are laid in square recesses formed in the ends of the cylinder, the depth of the recess being such as to just allow room for the free play of the spring when the ends of the case are put in place.

Air is admitted through the opening shown at the upper left-hand side, and being confined to the space between the blades, is, by the contraction of this space as the cylinder revolves, driven out as it approaches the outlet, this contraction of the space being the result of the eccentricity of the cylinder relative to the case.

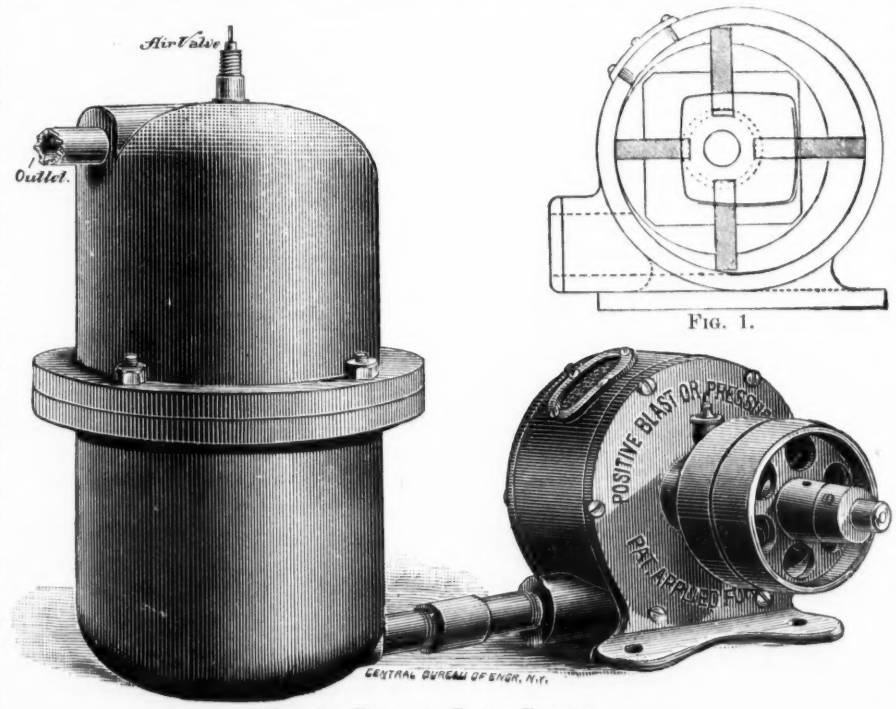


FIG. 2.—POSITIVE BLAST BLOWER.

FIG. 1.

It will be perceived that the blower consists of but few pieces and is quite simple in construction.

Experiments were made with quite a number of different materials for the blades, with a view of ascertaining which would give the best results as to frictional resistance developed, and durability. The results showed decidedly in favor of lignum vitæ, boiled in oil and beeswax.

Among other advantages claimed for the blower, is the fact that a comparatively slow speed is required, because each revolution measures and forces through the delivery a definite quantity of air, so that the supply is practically proportioned to the rotative speed.

The air tank or reservoir, shown in Fig. 2, is not always used, being needed only when a particularly steady blast is required. At the factory we saw a small blower, 4½ in. diameter and 2 in. wide, running at about 600 revolutions, maintain a steady and strong blast through a comparatively large opening, a gauge attached showing a pressure of 5 lbs. to the square inch.

When desired, the blower can be so arranged as to receive a supply of gas with the air, in any desired proportion, for producing the Bunsen flame.

All the parts are made to standard gauges, are interchangeable, and can readily be supplied when needed.

They are manufactured by F. W. Gesswein, 39 John street, New York.

Life-Saving Apparatus of Reindeer Hair.

A Norwegian engineer, Herr W. C. Moller, of Drammen, Norway, having had his attention drawn to the extreme buoyancy of reindeer hair, has succeeded in constructing various articles of this material for life saving at sea, with which some interesting experiments were recently made. The first life-saving object tried was one which can be used on board ship, as a chair, bedstead or couch, but which, in case of need, may be converted into a small boat. This apparatus was found capable of supporting three full-grown men in the water, although only intended to bear two. Another object tried was a suit made entirely of reindeer hair, and covering the entire body except the face, and in which a man floated on the water without having to make the slightest movement. It was found perfectly impossible to dive in the dress. The third object tried was a door-mat made of reindeer hair, and this supported a man easily, although he was dressed in full outdoor clothing. On comparing life belts made of reindeer hair with similar ones made of cork, it was found that the former were much lighter than the latter—a very important advantage to an exhausted drowning person when he has to put it on in the water. Herr Moller's assertion that reindeer hair is capable of supporting a weight ten times its own was fully borne out by these experiments. It should be pointed out that jackets, belts, etc., made of reindeer hair, are soft and pliable, and that they impart a good deal of warmth.—*London Iron.*

In some of the gas wells from which the flow has become weak, the experiment of deeper drilling has been tried, it is said with good success in nearly every instance.

There is a remarkable body of gold ore in Alaska. It is in a cliff fronting the ocean and is 250 to 300 feet wide, practically inexhaustible in body. It is a rich quartz. Senator Jones, of Nevada, has a fifth interest in the mine. Tredwell, the man who discovered it, owns another fifth.—*Chicago News.*

The Locomotive recently published cuts made from photographs of sections of boilers which have been very badly corroded by water contaminated by sewage, such as the leakage of privy vaults, etc. The corrosion is of a bad and dangerous character, and shows that it is necessary to see that such impure water is not allowed to enter boilers.

A correspondent of *Engineering* makes the sensible suggestion that stop valves on marine boilers should be so arranged that they can be closed, in an emergency, from the upper deck. While this has been done in a few instances, as a rule the stop valve on the boiler is so placed that in case of the bursting of the main steam pipe it is impossible to shut off steam, and this has resulted in fatal accidents.

Modern Locomotive Construction.

By J. G. A. Meyer.

FIFTY FIRST PAPER.

PROPORTIONS OF LOCOMOTIVE FRAMES, CONTINUED.

Dimensions of Frame Braces.—To the upper frame brace B_2 in Fig 292 (also see Figs. 271 and 274) are bolted and attached some of the principal parts of the locomotive. The forces acting upon the braces are of a complex character, and therefore to find the exact dimensions of the braces, which will give them the required strength—no more and no less—to resist the forces acting upon them, would be a very difficult matter.

Consequently, rules which are to be of any practical value for finding the dimensions of a locomotive frame, can only be empirical or arbitrary rules.

The following rules are founded upon the observation of the writer, and he believes that the results obtained by these rules will agree with the best practice of our time.

We have already established the width of the frames for the various sizes and classes of locomotives; our next step will be to find the cross-sectional area of the upper frame brace B_2.

One of the principal forces to which locomotive frames are subjected is the pulling force, or the horizontal force, which acts parallel to the frame braces B_2 and L. This pulling force is not equal to the total steam pressure on the piston, but for the sake of simplicity in establishing the following rules, and for the convenience of finding the dimensions of other locomotive frames, we may assume it to be so, without falling into any serious errors. Therefore we will again assume, as before, that the maximum steam pressure in the cylinder is 120 pounds per square inch. Comparing the total steam pressure on the piston with the cross-sectional area of the frame brace B_2 in the frames lately made, we find that when the cylinders are 11 inches and up to 18 inches in diameter, then one square inch for every 2000 pounds of the total steam pressure on the piston is allowed in the cross-sectional area of the frame brace B_2; for cylinders 19 and 20 inches in diameter, one square inch for every 2200 pounds; for cylinders 21 and 22 inches in diameter, one square inch for every 2400 pounds; and for cylinders 10 inches and less in diameter, one square inch for every 1700 pounds of the total steam pressure on the piston is allowed.

According to these figures it will be seen that the cross-sectional area of the smaller braces is greater than that of the larger braces, when these are compared with their respective piston pressures. This is as it should be, because the ratio between the depth and width of the smaller braces, or we may say, the distribution of the metal in the smaller braces, is not as good for obtaining the necessary strength to resist the forces which act in a vertical direction, as the distribution of the metal in, or the ratio between the depth and breadth for the larger braces, and therefore the larger frame braces can resist all the forces acting upon them with comparatively less metal than the smaller braces. It may be asked, Why cannot we make the form of cross-section in smaller frames similar to that of the larger ones? To this we answer that the widths of the frames are determined by certain conditions, as explained in our last paper, and cannot be changed; therefore if we attempt to make the depths of the smaller frame braces B_2 equal or nearly equal to the breadth of the frame, as is often the case in larger frames, we waste material or obtain frames too heavy for the smaller locomotives.

Hence, for finding the area of those portions of the locomotive upper frame braces which are marked B_2 in Figs. 292, 271 and 274, we have the following rules:

Rule 32.—For locomotives having cylinders 22 or 21 inches in diameter divide the total maximum steam pressure in pounds on the piston by 2400; the quotient will be the number of square inches in the cross-sectional area of the part of the frame brace marked B_2.

For locomotives having cylinders 20 or 19 inches in diameter, divide the total maximum steam pressure on the piston by 2200.

For locomotives having cylinders 18 inches or less in diameter down to 11 inches in diameter (the latter included), divide the total maximum steam pressure on the piston by 2000; and for cylinder 10 inches and less in diameter divide by 1700; the product in each case will be the required area in square inches of the frame brace B_2, suitable for cylinders of different diameters.

Ex. 62.—What should be the cross-sectional area of the upper frame brace in a locomotive having cylinders 17 inches in diameter? maximum steam pressure on the piston is 120 pounds per square inch.

The area of a piston 17 inches in diameter is equal to 226.98 square inches; hence

$$\frac{226.98 \times 120}{2000} = 13.618$$

square inches in the sectional area of the upper frame brace.

Depth of Upper Frame Brace.—When the area of the upper frame brace B_2 is known, and the width of the frames established as in Figs. 271 to 279, the depth of the upper frame brace can be readily obtained, thus:

Rule 33.—Divide the area of the frame brace B_2 by the suitable width of frame given in Fig. 271 and up to Fig. 279.

Ex. 63.—What should be the depth of the upper frame brace for a locomotive having cylinders 18 inches in diameter? maximum steam pressure on the piston is 120 pounds per square inch.

The area of a piston 18 inches in diameter is 254.47 square inches; hence, according to Rule 32 the area of the upper frame brace must be

$$\frac{254.47 \times 120}{2000} = 15.26 + \text{ sq. in.}$$

In Fig. 271 we see that the suitable width of the frame for a locomotive with cylinders 18 inches in diameter should be 4 inches.

According to Rule 33 the depth of the brace will be

$$\frac{15.26}{4} = 3.81 \text{ inches.}$$

Comparing this answer with the dimension given in Fig 271 we find the two to agree very nearly. By the same rules the depths B_2 of all the upper frame braces in Fig. 272 and up to Fig. 279 have been obtained; and in order to avoid in these dimensions $\frac{1}{16}$th of an inch, the depths of the upper frame braces given in some of these figures are very nearly $\frac{1}{8}$ of an inch deeper than obtained by the foregoing rules.

The part of the upper frame brace marked B, which forms the top of the pedestal jaw, is generally made $\frac{1}{4}$ of an inch deeper—sometimes more—than the depth of that part of the upper brace marked B_2; by so doing, the stiffness of the pedestal jaw is increased, and will, to some extent, prevent injury to the pedestal jaw when the bolt D or the pedestal cap C is removed.

The portion of the upper frame brace, marked B_3, between the rear pedestal and the rear end of frame, in Fig. 292, is not subjected to such severe vertical force as some of the other portions of this brace, and therefore the depth of that part marked B_3 is generally made $\frac{1}{4}$ of an inch less than the depth found by Rule 33.

Thickness of Pedestal Legs.—The thickness, marked o, of the pedestal legs in Figs. 292, 295 and 280 is not always made alike by the different locomotive builders. Our practice has been to make the thickness o for straight pedestal legs equal to the depth of the frame brace B_2, and found by Rule 33; and for the tapered pedestal legs, the thickness o in the center of the length of the leg was also made equal to the same depth B_2, found by Rule 33. These dimensions of the pedestal legs have always given good satisfaction, and we believe can be safely adopted.

Depth of the Lower Frame Brace.—It will be noticed that when the cast-iron thimble T and the bolt D at the bottom of the pedestal, Fig. 295, are used, we are compelled to place the lower frame brace L nearer in line with the center of the driving axles than when pedestal caps are used, as shown in Fig. 292; and therefore the lower frame brace L in Fig. 295 will be subjected to a greater pulling force than that in Fig. 292, because the lower brace in the latter figure acts with a greater leverage than that in the former figure. Hence, for finding the depth of the lower frame brace L, we have the following rules:

Rule 34.—When cast-iron thimbles at the bottom of the pedestal are used, as shown in Fig. 295, multiply the depth of the upper frame brace B_2, as found by Rule 33, by the decimal .86; the product will be the depth of the lower frame brace L.

Rule 35.—When pedestal caps are used, as shown in Fig. 292, multiply the depth of the upper frame brace B_2, as found by Rule 33, by the decimal .69; the product will be the depth of the lower frame brace L.

Ex. 64.—What should be the depth of the lower frame brace for a locomotive having cylinders 18 inches in diameter, when cast-iron thimbles are to be used at the bottom of the pedestal, and the maximum steam pressure is to be 120 pounds per square inch of piston?

We find in Fig. 271 that the depth of the upper frame brace B_2, suitable for this size cylinder and steam pressure, is $3\frac{3}{4}$ inches; hence we have, according to Rule 34:

$3.75 \times .86 = 3.22$ inches for the depth of the lower frame brame brace L.

Ex. 65.—What should be the depth of the lower frame brace for a locomotive having cylinders 11 inches in diameter, when pedestal caps are to be used at the bottom of the pedestal, and the maximum steam pressure is to be 120 pounds per square inch of piston?

In Fig. 278 we find that the suitable depth of the upper frame brace for this size cylinder and steam pressure is 2 inches; hence we have, according to Rule 35:

$2 \times .69 = 1.38$ inch for the depth of the lower frame brace L.

Since the bottom surface of this brace is not planed along the entire length, that part of the same brace to which the pedestal cap is bolted is usually made $\frac{1}{8}$ to $\frac{1}{4}$ of an inch deeper than the depth found by the rule. This extra depth of the lower frame brace will restore some of the strength lost by the holes drilled for the pedestal cap bolts.

Thickness of the Pedestal Cap.—The thickness C of central portion of the pedestal cap is usually made $\frac{1}{4}$ of an inch less than the depth of the lower frame brace L.

The projection u, Fig. 280, of the pedestal jaw, generally extends into the cap $\frac{7}{8}$ of an inch for the smaller engines, and 1 inch for the larger engines; and since the bottom of the projection u is generally in line with the top of the central portion C of the cap, it follows that the ends of the pedestal cap must be made that much thicker.

The projections u are slightly tapered, so that they can be easily entered into the recesses in the cap, and when the cap is screwed fast into position will firmly hold the ends of the pedestal jaw.

Number of Bolts in Pedestal Caps.—It is the general practice to secure the pedestal caps in small engines with two bolts, and in larger engines with four bolts. We believe that it is good practice to use two bolts for securing the pedestal cap to frame in locomotives having cylinders 14 inches and less in diameter. In larger locomotives four bolts should be used for each pedestal cap. The diameters of these bolts are given in Figs. 277, 278, 279 and 280.

Fig. 292 represents a frame for a consolidation engine, having cylinders 20 inches in

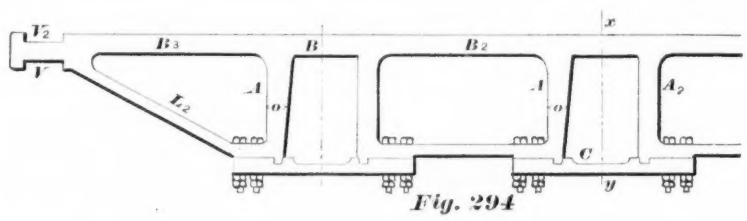


Fig. 294

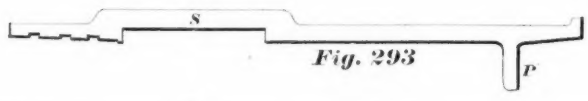


Fig. 293

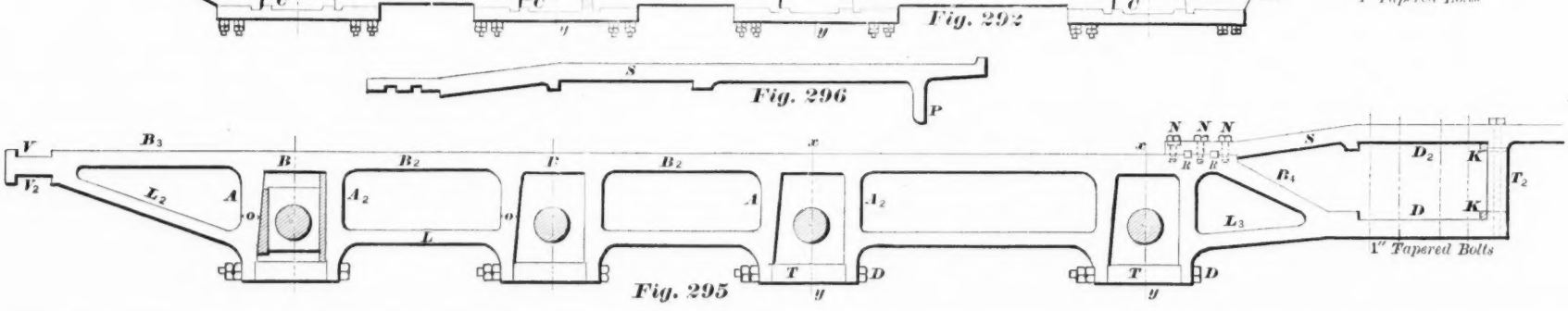


Fig. 292

Fig. 296

Fig. 295

diameter, with all the pedestal legs tapered. Formerly nearly all frames had pedestals of this kind, but lately a great number if not the majority of frames have pedestals in which one leg is straight, as shown in Fig. 294. It will be noticed that all these pedestals have caps. Fig. 295 represents a frame for the same class and size of engine in which cast-iron thimbles are used at the bottom of the pedestal jaw. We have frequently seen frames with this kind of pedestal in Mogul, ten-wheeled and eight-wheeled engines, but have not seen these pedestals used in frames for consolidation engines. This frame has been designed for these papers, and we believe it to be the best that can be used in consolidation engines.

Twenty-Inch Lever Drill.

We illustrate with this a drill made by the Bickford Drill Co., Cincinnati, Ohio. The design is in the direction of producing a tool that is strong, convenient and durable. All shafts and spindles are made of steel. The spindle is counter-balanced by weight inside of column. All gears and pinions are cut from the solid. The table is adjusted to height by rack and pinion, turns in the arm and swings around the column.

The Gas Meter Dangerous.

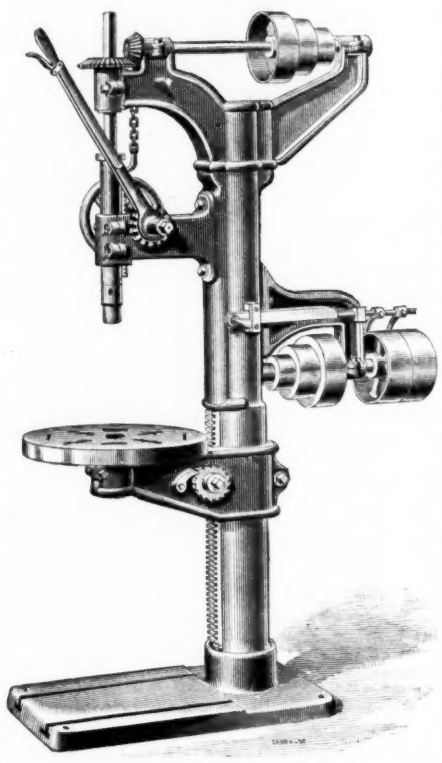
The meters which gas companies introduce into our houses are put together with solder that melts at a low degree of heat. When a fire originates near a gas meter the heat very soon causes it to fall apart, and the unchecked flow of gas from the influent pipe quickly fills the premises with a roaring and devastating flame. After every fire, when there is a total loss of the building, a blazing stream of gas roars on beneath falling walls and debris, until measures are taken to stop the supply of gas from the street mains. With these facts before everybody's eyes it seems strange that no attempt is made to have meters differently constructed, or some way devised to prevent the loss that necessarily results from the present state of things.—*The Engineer.*

Because it is English.

"It would seem that Americans are inferior to the English as 'bus builders, if we are to judge from the fact that the New York Fifth Avenue Stage Co. insist on having theirs from London."

The above, which we take from the *Practical Engineer*, would seem upon the surface, perhaps, to be a reflection upon the ability of our American coach builders; but to one who has an opportunity of walking along Fifth avenue of a fine afternoon, as the writer recently did, it is easily explained upon a different hypothesis. He will there see abundant evidence that many of the people living upon that avenue, which is famous for its wealth, have gone far beyond the point at which they can take any satisfaction in anything American (with a few minor exceptions), no matter what its degree of excellence. To suit their super-fastidious tastes, a thing must be English, "don't you know," and it is simply because these omnibuses "are English," and for no other reason whatever, that they are considered best qualified to roll over the aristocratic pavements and transport the aristocratic Anglo-maniacs of that quarter, who, notwithstanding the fact that their wealth is derived from American enterprise and industry, affect to despise everything American. We sometimes wonder that before this, some of the American railroads have not put on trains made up of English coaches and English locomotives, for the accommodation of these——— American citizens!

Doubtless it is the duty of a Christian to feel a certain degree of pity for such people, in whom the idleness, resulting from the possession of wealth, has produced a mental condition of such "strenuous vacuity," as to cause them to be completely absorbed in a weak effort to imitate the manners and customs of people who in turn despise and ridicule them; but in our present state of moral development we confess we find it impossible to entertain any other feelings than those of the most cordial contempt for people who, while they claim American citizenship, despise and sneer at things American, simply because they are American, and make every possible use of the productions of foreign countries, simply for the name of it, and to the injury of American industries, without which many of these same people would be little better off than paupers.



TWENTY-INCH LEVER DRILL.

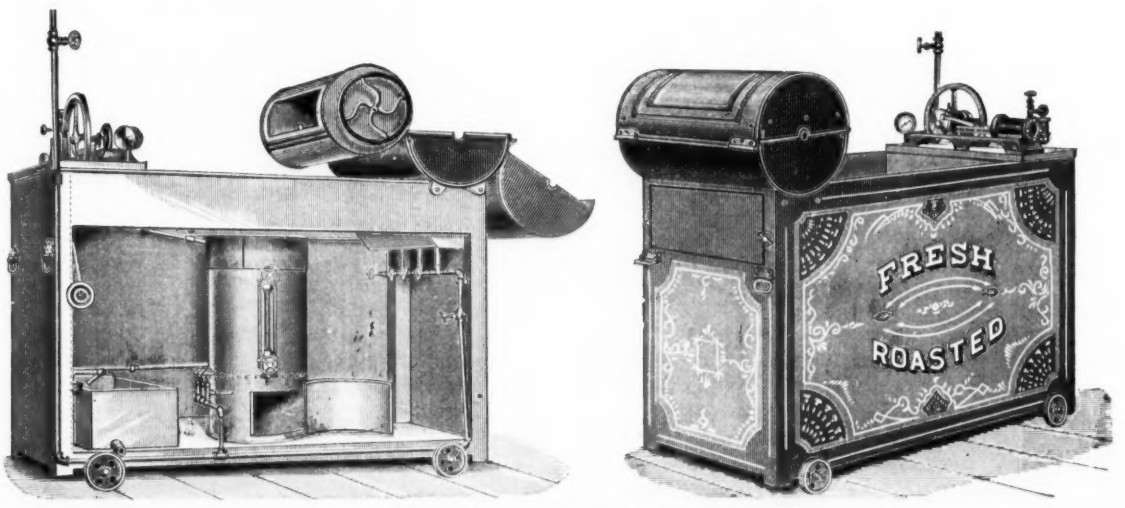
Steam Nut and Coffee Roaster.

The machine illustrated herewith belongs particularly to the mechanical paraphernalia of the modern grocery store. It is designed for roasting coffee, peanuts, etc. It is four feet long, twenty-two inches wide and thirty-two inches high to top of nut pan, and weighs two hundred and ten pounds.

The iron plate upon which the engine rests, also the bed plate and fly wheel of engine, are nickel plated, the remainder of the machinery is polished brass.

The engine is two inch bore and three inch stroke, with key and set screw connections. The piston head packing is three rings, like the best of engines.

The boiler is made of best flange steel, rolled expressly. It is eleven inches in diameter by fifteen inches over all, with fifteen one inch brass flues. It is made safe for one hundred and fifty pounds of steam, but the safety valve is set at forty pounds, as that is more than enough to run it. The manufacturer is W. E. Vernon, Oskaloosa, Iowa.



STEAM NUT AND COFFEE ROASTER.

The executive committee of the Master Car Builders Association has taken means to bring about the appointment of a sub-committee to examine the different forms of couplers coming within the Master Car Builders' type, and report the result of their examinations to the executive committee. The committee consists of Messrs. Wall, Wade, Lontz, Cloud and Forney.

LETTERS FROM PRACTICAL MEN.

A Growl About Water Columns.

Editor American Machinist:

I believe it is quite true that perfection is evolved from fault-finding and as a believer in perfection I want to growl about the present style of water columns. Since the advent of the water column, gauge cocks are no longer placed in the front head or shell, and the engineer must depend entirely on the gauges on the column. Now the column, as it is now made, has no provision for cleaning the lower pipe leading to boiler, and this pipe has a very sinful habit of getting full—of lime. You then can take out the lower water glass valve and run a 3-16″ wire through, only to discover the pipe (which is $\frac{3}{4}$″) is closed. The average engineer won't take out the water glass to remove the fixture and clean the pipe, and as he crawls over the flues on a fine Sunday morning, to clean that pipe, he will, in all human probability, cast some heated reflections. I have been there. But I think if the water column is made with a $\frac{3}{4}$″ plug directly opposite, and in same line with the water pipe, it would be much better for getting at the water-pipe for cleaning. The gauges and glass fixtures would have plenty of room left on the column. Then there is that combination of elbows and nipples between the column and boiler. I prefer to use tees in place of elbows, and to so arrange them that I can, by taking out the plugs, thoroughly clean the pipes without taking them down. Use plumbago on the plugs and they will not stick.

Then again, I think the column should be tapped for and receive $1\frac{1}{4}$″ pipe. In place of the small drip cock on lower end of column, I prefer to tap the end for $\frac{3}{4}$″ pipe, put in nipple 12″ long and plug valve. This makes an excellent settling chamber, and if blown every two hours will greatly help to keep the water pipe clean.

T. T. PARKER.

Prof. Sweet's Spring Roller Problem.

Editor American Machinist:

I think the spring roller problem is a good one to develop the thinking faculties of mechanics. The problem, as it would come up in the machine shop, would be to make a roller that would fill the bill with the least outlay of labor. I believe every one will agree with me that to do any very fine calculations would be a waste of time, for such calculations involve the highest form of mathematics, and after completed, only form the basis of the first trial. If, in the first trial any figuring is to be done, the best plan would be to find some old bush or ring and load it. Then by a few simple ratios compute the size required, remembering that the deflection will be directly as the cube of the diameter, inversely as the cube of the thickness of the walls, inversely as the width or length of the roller and directly as the load. But even this simple method of calculation I believe would cost more than it would come to. I do not claim that the way I am about to describe would be the best way to do the job, but it would be the best way for me, because it is the first way that suggests itself, and any thought spent on devising a better way would count on the cost side of the account.

I would cut the roller to length, rough bore it by guess to a size I thought would surely leave metal enough in the ring, put it on an arbor and turn the outside to size. I would then clamp it down on the platform of a weighing scale, load it to some ratio of the load to be put on it, and note the spring; when correct, it would deflect an equal ratio of the required amount of deflection. For example, $\frac{1}{4}$ the ultimate load to be put on should cause it to deflect $\frac{1}{4}$ the required amount.

I would not load it to full load before tempering, for fear of permanent set. I would likely find by first trial that the walls of the roller were too thick. I would then chuck a block of cast iron, and bore it out to the size of the outside of the ring, boring a true shoulder inside; this would be used as a chuck to hold the roller true with the outside while making the succeeding trial boring cuts. I would then continue to bore and try until I got it right, every time making a little mental calculation, based on the fact that the deflection would increase as the cube of the thickness of the walls is diminished. After getting it correct I would temper it and load it up to full amount, and if I wanted accurate results, I think this roller would be called the first trial roller.

Experiments on the soft roller are good guides, for the stiffness of the roller would not be increased by tempering, as many suppose, the modulus of elasticity of soft steel and of spring tempered steel being practically the same. The soft roller would of course take a permanent set at a lower load, but this would be the only difference in their behavior.

JOHN COFFIN.

Examination of Engineers.

Editor American Machinist:

There has been much written of late on the subject of licensing engineers, but there are, I think, one or two points in regard to their examination as to qualifications that have escaped notice. So far as I have been able to learn, the idea expressed by most persons is that a specified amount of experience, and of a certain specified kind, should be required, and this, in fact, is required by existing laws.

This no doubt makes it easier for the examiners and tends to relieve them of a portion of their responsibilities, but it seems to me to be unfair and unjust to a large number of men, and in fact to all who desire to change their particular branch of engineering, be their reasons what they may, and also seems to favor a monopoly of any branch, to those engaged in it as against all others.

A law which requires this specified amount of experience, and of a specified kind, practically places a premium on ignorance, and a high one at that, for it in effect says, that what a man has learned and knows about packing, making joints, grinding in valves, care of bearings and the hundred other things an engineer has to do, are of no value whatever, when he desires to take up another branch of the business, he having to go through the same routine, and likely as not spend a year or two under a man who actually knows much less about the general repairs of engines than himself,

in order to get the necessary amount of experience in that particular department.

This, although he has spent years in study, and much money for books, in trying to get a thorough knowledge of the principles involved, and is possessed of a natural taste and skill in that direction, may be a good machinist as well. All count for nothing; he is put on the same plane as the wood chopper or the coal heaver, who is only attracted towards an engineer's position by visions of large pay and light work, and who cares only enough about the business to be able to keep his place, and who will never get more knowledge than the necessary legal amount of stuffing.

That this is gross injustice requires no argument to prove. A law requiring all persons having steam power to employ an engineer having had at least one year's experience would prove very burdensome, and would do much to hinder the manufacturing industries of this country, as well as to foster a monopoly of the engineering business, there being many small shops where to pay a man as engineer and have him do nothing else, would result in stopping the business, and if such a law was in force he could do as he pleased, and might in some cases be heard to say, if he told his thoughts: "If you don't employ one of us the law will stop you entirely, and we all belong to the Amalgamated Society of Engineers, whose avowed object is to keep our pay at $2.50 to $3.50 per day, and do as little as possible."

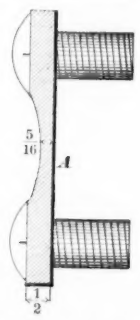
I do think, however, and most decidedly too, that all persons having in any manner the generation of steam pressure for whatever use in charge, should have a knowledge of the strains involved, both by the pressure itself and by the expansion and contraction; a fair idea of the signs of weakness, and withal a fair amount of common sense. All of which can be determined by a competent examiner, who should be paid by the people at large, for they are the ones directly benefited, and whose political opinions should have no power either in placing or removing him from office. Thorough knowledge and honesty should be his prime qualifications. The night and Sunday watchmen in factories should not be overlooked in these examinations, and certificates of such examination and knowledge should be given, covering the ground over which they have been examined, if they are found competent.

It would seem best that local examiners should be provided, to be created by the principal examiner, when on his rounds, from the best local talent he can find, who are to give certificates after examination of applicants, but the applicant to be subject to a further examination by the principal examiner when he next comes around.

"A little knowledge is a dangerous thing," and as those who assume to know it all are very likely to have only the dangerous amount of knowledge, and are so conceited as to be but little likely to ever get any more, it would be well for all concerned to give them a very thorough examination before giving a certificate.

The opinion is held by some—myself among the rest—that the clause in the U. S. Marine License law requiring all applicants for license to have had at least a year's experience on a boat of 20 tons or more in the engineer's department is open to the same objections cited in the first of this article. I know men who have had many years' experience on small boats of from 10 to 15 tons, their engines having condensers in all cases, some being compound and some being triple expansion engines, who would be compelled to remain where they at present are by this clause in the law. Whereas, if they had only begun by firing on a 20-ton boat with a single cylinder simple non-condensing engine, maybe the highway to the highest position in marine engineering would be open to them. I think all persons should be examined before advancement in any grade or class of steam engineering, and advanced by their knowledge, instead of time of service.

I will give an illustration of this point by a case of which I know the facts. A man having fired the usual time, three to four years on a locomotive, was set up. After reasonable luck in running for some years, he met with an accident, by which the left side of his engine was disabled. The back end of main rod let go, which resulted in bending the main rod, bending the guide yoke and piston rod, breaking the piston and both heads of cylinder, but did not knock them clean out. He covered the ports with the valve on that side, and got the chest cover on again all right, but instead of replacing the oil check in chest cover he left it out, thus leaving an open hole something like $1\frac{1}{8}$" diameter. He then ran her some twenty miles to the shop, with the hole open as described. When asked by the master mechanic why the oil check was left out, the engineer explained it was to relieve the pressure on that side, for with the valve and piston not working, it would have no outlet, and would of course accumulate and burst the chest. This was his last trip on that road; he was discharged for ignorance. Had this man been examined by a competent examiner, one who goes deep enough to see if the applicant understands the principles of the subject, he would never have reached an engineer's position at all, and consequently would not have stood in the way of the promotion of a deserving man. Q. E. D.



Thickness of Boiler Plates.

Editor American Machinist:

The fact that the thickness of boiler plate exposed to the fire is limited to three-eighths inch, will have more to do in the future than in the past in limiting the diameter of the shells of tubular boilers, because the movement is always in the direction of higher steam pressures. More boilers of a smaller diameter will be the order.

The statement above, extracted from the American Machinist, I believe to be correct, notwithstanding the fact that U. S. inspectors pass plates $\frac{5}{8}$" or $\frac{3}{4}$" thick.

The Baldwin Locomotive Works, of Philadelphia, have found, in their long experience in locomotive boiler fire boxes, that thick plates, after a few years, become reduced in thickness to between $\frac{5}{16}$" and $\frac{3}{8}$" thick between the stay bolts, when it will remain at that thickness until the boilers are condemned. The fact that the iron is reduced by burning is evident by the plates themselves; between the stay bolts, the thickness is reduced to the minimum, as above stated, while at and around the stay bolt it remains about the original thickness, as per sketch.

At *A*, the plate is reduced to $\frac{5}{16}$", due to the fact that the transfer of heat is not as rapid as at the stays, the latter aiding in transferring the heat to the water, while the plate is burned away, due to the less amount of metal to convey the heat from the fire to that of the water, and as a result, is burned to that thickness that the water will absorb all the heat taken up by the plate.

This is more perceptible in copper fire boxes than in iron ones, as copper boxes are $\frac{1}{8}$" in thickness generally.

Then again, the advantage of thin plates over thick ones is very marked. It is well known to all boiler engineers that thin plates tend to keep their surfaces in a cleaner, and therefore a better state for conveying the heat from the fire on one side to the water on the other. Granting that this takes place, we should here find another reason in favor of thinner material, as a rise in temperature of iron is attended with a proportionate diminution in its conducting powers. Mr. J. D. Forbes, of Edinburgh, has shown that the conducting power of wrought-iron at 392 degrees Fahrenheit, is little more than one-half of its conducting power at 32 degrees.

W. Barnet Le Van.

Exhaust Steam Heating.

Editor American Machinist:

If L. L. K., of Kearney, Neb., will hang 4 $1\frac{1}{2}$ pipes from the ceiling of his mill and let them extend all around the mill, having the header where the steam enters, say one foot higher than the header where the drip is taken out, I think he will have a very satisfactory arrangement. The four $1\frac{1}{2}$ pipes have the same area as the 3" exhaust pipe, and the proportion of heating surface to cubic contents would be about 1 to 65. The hangers should be about ten feet apart, and there should be a back pressure valve on the exhaust pipe loaded to blow off at about two pounds.

The drip can be connected to a hot well in engine room, and if only mineral oils are used for lubricating, it can be pumped back into the boiler.

There should be a 1" live steam connection to coil to warm it up before engine starts in the morning.

The following condensed facts on exhaust heating may be of interest:

The branch tees or headers should be of large pattern; the inside area of body should be equal to the combined area of outlets.

Where the drips from a number of coils using exhaust steam are connected with one return pipe, each coil should have an inverted siphon on the drip connection, to prevent steam blowing through the coil.

Where the connecting pipes are amply large and the coils are not too long, the back pressure will be practically nothing. If the pipes are small, by connecting a pump to the end of the main drip pipe a vacuum can be maintained in the piping and a back pressure valve is not necessary.

The best system of exhaust heating is where the main exhaust from engine is carried to the top story of building, and the main distributing pipe is run under ceiling of top story, having branches supplying the different floors running downwards.

New York. H. J. Barron.

Hot Air Heating.

Editor American Machinist:

We notice in a recent number of the American Machinist, a description of the shop-heating device of the Walker Manufacturing Company, in which it is stated that it is believed to be new for shop heating. The plan is a most excellent one, as we have proved by using it for the past ten years, excepting that we do not have occasion to carry the heated air from one building to another. This system of heating has doubtless been adopted by many shops, as it has been advocated for some years. In our case the exhaust steam from our engine furnishes sufficient heat.

William Tod & Co.

Youngstown, Ohio.

Initial Stress in Bolts.

Editor American Machinist:

Your correspondent W. W. (Oct. 29), who hails from Hoboken, ought not to be led to believe that I think oscillatory stress can be done away with by proper initial tightening. If he will read more carefully he will see that I have ceased to think so, long enough since. It is a matter of belief and can be done, your correspondent to the contrary nevertheless. W. W. only begs the question when he supposes a spring to be placed between the head of the cylinder and the flange. A spring thus interposed would necessarily increase the bolt tension, and only proves how far our student is at sea. If he is determined to make the case clear by the addition of extraneous substances, he should be careful to place his explanatory springs in the right place. And I now invite him, on his own line of argument, to place his springs between the nut and the cylinder head (or, as I term it, cover). Let him compress each one to 1,600 pounds, as before, and think the matter out in this newer and truer light, and I think he will confess that the cover is held down by a force of 1,600 pounds per bolt; and that until the internal cylinder strain pressure rises above 1,600 pounds per bolt, there cannot come one ounce of increase of tension. Will W. W. show how any increase is possible? Concerning his final paragraph, I would merely say that it is based on his previous false assumptions, and therefore falls to the ground equally with their demolishment. It is strange to find a technical school student falling into such curious errors of misconception, and only shows how very little this question of initial stress is understood by those who should know better.

New York. W. H. Booth.

Still More Initial Strain.

Editor American Machinist:

W. W.'s method of illustrating the initial strain question, by supposing a spiral spring placed over each bolt, in his article in your issue for Oct. 29th, is a good one, but why "suppose the head is separated from the flange by a small space"? The springs must of course be supposed to be compressed by screwing up the nuts until each is exerting a resistance of 1,600 pounds, that being supposed to be the force each would be subjected to from the steam pressure. Then, if we suppose a space, we must suppose distance pieces or something of the kind inserted to maintain it against the force of the springs. But, manifestly, no more than the 1,600 pounds of spring force would be imposed on each bolt till the springs should be further compressed, whether a space separating head and flange existed or not; and they would not be further compressed till the force on each exceeded the 1,600 pounds, after which they would each have exactly that due to the steam pressure, the same as if no springs were used. All steam pressure short of that required to overcome the 1,600 pounds spring force would be received by the head, not the bolts.

Salem, Ohio. J. W. Thompson.

"Careless" Locomotive Engineers.

Editor American Machinist:

In your issue of Oct. 29th, J. F. Marsh makes some statements relating to engineers that read well, to an outsider. His remarks about Mr. Hill's views are all right, but he launches in about heedless, careless men, who destroy more than they use, and cites the daily papers with regard to air-brake failures, and says in his opinion most of such failures, and perhaps all of them, are chargeable to those careless engineers. Engineers of intelligence will not agree with him in this matter. Common sense will tell Mr. Marsh that no brake has been devised yet that can be relied upon, absolutely, no matter how good an engineer is in charge; and if he has had an extended experience with such brakes, he has surely found instances where the "unexpected" has happened.

He speaks of an engineer on his road once who did not use the brake properly. Mr. Marsh should remember that ignorant, reckless, incompetent men can be found in all occupations of life, but any fair-minded railroad officer will testify that locomotive engineers as a body are not reckless, careless, or extravagant of company's supplies.

Mr. Marsh wants an examination of engineers; wants them to come up to a certain standard, etc. Now, what prevents master mechanics on the different roads from examining engineers when they make them? Who is more competent to conduct such examination than the master mechanic? Surely not the political appointee who would conduct such examinations under a license law. Better leave well enough alone. Keep the locomotive men out of the hands of outsiders, who do not understand or appreciate their responsible positions. Let railroad mechanical heads of departments conduct the examinations of engineers in matters pertaining to machinery in their own way; then railroad companies will get reliable men for such positions, if they have a reliable man con

ducting the mechanical department—and in the nature of things they have such men now-a days.

J. J. CLAIR, Locomotive Engineer.
Pittsburg, Penn.

Tail Stock Adjustment.

Editor American Machinist:

In the AMERICAN MACHINIST for October 22 you quote from a contemporary, in which W. D. Forbes says, among other things: "Now that the patent on the taper attachment has expired, there is no reason why the tail stock should have a set-over. Good results cannot be hoped for by its use, while perfect work can be had from the taper attachment," etc. Your criticism which follows is good and to the point. I desire to contribute a few remarks by saying that W. D. Forbes' experience upon an engine lathe must be very small; the proof is that if he were posted upon the repeated adjustments required by the very best of engine lathes, he would never have written as he did.

A great many contributors have advocated placing the two centers exactly in line, then take a long piece and turn, say one inch in length on each end, exactly the same diameter; then move the carriage and tool close to the head-stock, to prove if the tool will touch at each end alike; now if found correct, they advocate drilling and reaming a hole somewhere in the two parts, which slide one over the other, and then fit a steel pin. This is done so that when the tail stock is set over, the pin can be replaced, and the lathe is in position for turning straight.

If it were possible to make all parts of a lathe so that there need be no adjustment, then a great mechanical feat would be accomplished. In all the matter which has been written upon this subject, one point has been overlooked; that is, the dead center, or the center which fits in the spindle of the tail stock, has to be hardened, and as a result, it is sprung more or less; and as is often the case, the center is not marked so that it may be replaced in the same position. Now, it is not every shop that has a device for grinding the center true after hardening, so it has to be placed in the spindle in a bad condition. Now, W. D. Forbes and others who advocate a lathe made so that the tail stock cannot be adjusted, or who think that a pin is essential, can readily see what trouble is in store for them. Again, it is not every lathe hand who will place the dead center in place twice alike; it will thus be seen that if the tail stock had been adjusted to turn straight in one place, and the center was removed, and not replaced exactly in the same position, the lathe would turn tapering. Still again, another obstacle presents itself; as is well known, there is a device upon the tail stock used to clamp and hold the spindle firmly. Now, some workmen will set the lathe to turn straight, without binding the spindle; another will squeeze the binding screw as tight as his strength will permit; the result is, that the spindle is forced down and the lathe turns tapering. Again, it is well known that with a large number of lathes, there is trouble from the ways of the bed being wider in some places than others; also, that the bed or ways are bowing, high in the middle and low at the ends. Now, it is seen that if the tail stock is set true for one length, then, when moved a longer or shorter distance, it will turn tapering; so it will be seen that it is next to impossible to make a lathe turn straight in every position.

Jamaica-Plain. C. E. SIMONDS.

A Pleasant Incident.

The employes of the American Sewing Machine Company, of Philadelphia, recently enticed the assistant superintendent, James S. George, to the house of the superintendent, John J. Grant, where they presented each with an elegant gold-mounted umbrella. The recipients, although noted as good talkers, were surprised this time, and responded very briefly, if eloquently, to the well-prepared presentation speech of James Borer, foreman of forge department. The Washington Grays Military Band appeared upon the scene, and the evening was given over to enjoyment, the conspirators having taken Mrs. Grant into their confidence, so that preparations were complete.

Petroleum Refuse as Fuel on the Elevated Railroads of New York.

On the elevated roads of New York experiments have lately been made with petroleum refuse, used as fuel in one of their locomotives, and we believe with greater success than has been obtained on other roads. The dimensions of the furnace in which this refuse was used, are: length, 42¼ inches; breadth, 34½ inches; height, 44¾ inches. The trial trips of the engine were made by coupling it to one of their regular trains of cars during the busy hours of the day and conveying passengers along the road the same as is accomplished with one of their regular engines.

During the trip plenty of steam was made, no time lost, and in fact, everything worked very satisfactorily. With the present price of petroleum refuse, the engines can be run cheaper than with coal, but what the price of petroleum may become, when it should be generally adopted as fuel, is a matter of doubt, and this is one of the main reasons for the delay in its general adoption as fuel.

The apparatus for the burning of the oil is extremely simple and can be attached to a locomotive without changing any of its parts. The principle upon which the burning of this fuel is based is also very simple; air is admitted into an enclosure of brick-work built up inside of the furnace and there allowed to mingle with a proportionate amount of petroleum refuse and steam, so that a gas or vapor is formed which is easily ignited. The petroleum and steam is injected into this enclosure.

For this purpose an injector is used. This injector consists of two principal parts, namely, a cylindrical shell whose main body is $1\frac{3}{4}$ inches inside diameter and $8\frac{7}{8}$ inches long; the other part of the injector is a hollow spindle $1\frac{1}{4}$ inches outside diameter and $\frac{1}{2}$ of an inch inside diameter. One end of the cylindrical shell is fastened to the back head of the furnace, and this end we shall call the front end of the injector. Oil is admitted into the shell near its front end; and the steam is admitted into the shell near its back end. The steam and oil are prevented from mingling in the shell by a rib $\frac{1}{2}$ of an inch thick cast to the inner surface of the shell, about midway of its length and fitting the outer surface of the hollow spindle; packing is placed in front of the rib around the spindle, and held in position by a nut passed over the spindle and screwed into the shell. In order to obtain sufficient room for screwing up the nut the inner diameter of the shell near its front end is increased to $2\frac{5}{8}$ inches. By this arrangement, two distinct chambers are formed in the cylindrical shell or outer shell of the injector; the front chamber being the oil chamber, and the rear one the steam chamber. The front end of the shell is closed by a cap bolted to it. On the front face and in the center of this cap is cast a nozzle projecting two inches from the face of the cap. The cap itself is $1\frac{3}{4}$ inches thick, so that the length of the hole drilled through the center of the cap and nozzle is $3\frac{3}{4}$ inches. This hole is tapered, its diameter at the end of the nozzle is $\frac{7}{16}$ of an inch, and at the inner surface of the cap the hole is $1\frac{3}{8}$ inches in diameter. The taper is not straight, but slightly curved; in fact, similar in form to those in any ordinary injector nozzle. Into this tapered hole through the cap, the end of the hollow spindle is made to project. The end of this spindle is also tapered; the outer surface is tapered from $1\frac{1}{4}$ inches to $\frac{1}{2}$ of an inch in diameter, and the hole in the spindle is reduced from $\frac{1}{2}$ of an inch to $\frac{5}{16}$ of an inch in diameter; the length of this taper is two inches.

When this tapered end of the spindle is moved forward so that it will touch the inner surface of the nozzle, the oil in the oil chamber is prevented from flowing through the nozzle; and by moving the spindle back to given distances certain quantities of oil will flow through the nozzle of the injector; in this manner the supply of oil or petroleum to be used as fuel in the furnace is regulated.

For the purpose of conveniently regulating the supply of oil, a bevel wheel is fastened to the rear end of the hollow spindle, and this wheel gears with a smaller bevel wheel fastened to a shaft which works in a bearing attached to the rear end of outer shell of the injector. The shaft to which the small bevel wheel is fastened extends upward through the foot board to a convenient height above the latter, and to the upper end of this shaft is fastened an ordinary hand wheel. The oil is led into the oil chamber of the injector by a pipe $1\frac{1}{2}$ inch inside diameter; and the steam is led into the steam chamber of the injector by a pipe $\frac{3}{4}$ of an inch inside diameter; from the steam chamber the steam enters the hollow part of the spindle through a hole drilled into the shell of the latter, and from thence into the furnace, drawing the oil with it through the nozzle at the end of the injector.

The front end of the injector is fastened by four $\frac{3}{4}$ studs to the back head of the furnace, with the nozzle of the injector (through which the oil and steam passes) projecting into a wrought-iron thimble $1\frac{3}{4}$ inches outside in diameter set into the water space of the furnace.

Certain quantities of air are admitted into the furnace through the ash pan, the supply of air being regulated by the dampers.

When the air comes in contact with the oil and steam in the furnace, a gas or vapor is formed, which, upon being ignited, produces a flame of intense heat.

The direct impact of the flame is supposed to be injurious to the plates of the fire box; and again, the form of the present fire boxes is not suitable for a complete combustion of the vapor in the furnace. To overcome these difficulties, the inside of the fire box is lined with brick and laid in a manner which will form an enclosure suitable for the proper mixing of the air, oil and steam, and guiding the gas or vapor in the right direction.

The brick-work is supported by two wrought-iron bars, $6'' \times 1''$, running lengthways of the furnace, and fastened to the underside of the fire box ring; it is also supported by a plate stiffened by T irons running across the furnace. The brick-work extends upwards through about one half the depth of the furnace, touches the two sides of the furnace and leaves a clearance space of about 3 inches between it and the back flue sheet, down to about $3\frac{1}{2}$ inches from the bottom of the furnace; through this distance of $3\frac{1}{2}$ inches the brick-work touches the back flue, so that no air can enter at the front end of the fire box. The first row of bricks on the plate at the bottom of the fire box extends from the back flue sheet to within 21 inches of the door sheet in the furnace; above this first row the brick-work recedes from the door sheet, forming an angle of 40 degrees with a horizontal line; this slanting surface of brick extends upwards through a distance of 10 inches, measured from the wrought-iron plate; after this, the brick-work runs parallel to the back flue sheet, and extends upwards so that it will present to the flame a vertical surface $9\frac{1}{2}$ inches high. This portion of the brick-work is 9 inches thick. The brick-work touching the sides of the furnace is $4\frac{1}{2}$ inches thick and is laid to within 12 inches of the furnace door sheet. On top of these sides and the wall parallel to the back flue sheet is placed a brick arch extending across the furnace, and leaving a space 12 inches wide between it and the furnace door sheet for the heat to pass through, and thence over the arch into the flues.

This arch is $4\frac{1}{2}$ inches thick, and slants upwards towards the furnace door sheet, making an angle of 13 degrees with a horizontal line. Another course of brick-work, separate from the foregoing, is laid across the furnace and in contact with the door sheet, where this brick-work is 6 inches deep; it extends 9 inches in front of the door sheet and slants down to $2\frac{1}{2}$ inches deep. This brick-work reduces the air opening at the bottom of the furnace to 12 inches in width, and its length equal to the distance between the $6'' \times 1''$ bars which are fastened to the fire box ring as previously described.

The wrought-iron thimble before alluded to is placed close to the top of this brick-work, in the center of the width of the furnace, and arranged in a manner which will cause the sprays of oil and steam to strike the front wall about one-third of the distance measured downward from the top of slanting surface. In this brick-work enclosure the vapor or gas is ignited. The bottom of the ash pan is lined with cement to prevent the heat from warping it, and the brick wall which runs parallel to the back flue sheet is extended down to the bottom of the ash pan, so that air cannot enter the front end of the brick enclosure.

When the engine is standing still, only a small quantity of oil and steam is injected into the furnace, the dampers are partially closed, and a draft created by the blower in the smoke box. When the engine is to be started, and also when it is running, the fireman closes the blower cock, and regulates the supply of air by the dampers, the supply of oil by the hand wheel which moves the hollow spindle of the injector, and the supply of steam by the globe valve on the steam pipe leading to the injector, to such degrees which will cause a complete combustion of the gas and prevent smoke from issuing out of the smoke-stack. With the present arrangement it requires a careful and skillful fireman, also his constant attention to regulate the supply of oil, steam and air, but we believe that if the refuse of petroleum is to be used as a fuel in locomotives, the arrangement of the apparatus can be made simpler, and require less labor and attention on the part of the fireman to burn the petroleum without smoke.

Our English exchanges continue to show that the quality of tools furnished the British army is abominable in quality of material and workmanship. Referring to this the *Engineer* says:

This is no doubt the first of a series of communications from various firms. The probable explanation of untrustworthy tools is no doubt the old one of price. If the Government will persist in accepting contracts at lower figures than those at which the goods can be profitably made, the inevitable result must be a breakdown. No thoroughly good weapons or implements can be supplied without a profit. Manufacturers do not manufacture from motives of patriotism, but of profit. It is surely better that the Government should pay the proper wholesale price of a respectable house than risk sending orders to others who quote low to tempt trade. The British Government, it is said, "should buy in the cheapest market." This is altogether wrong. The British Government should do as all sensible people do—they should buy in the best market the best goods they need for their purpose, for the best goods are always the cheapest in the long run.

An apprentices' exhibition is to be held in London in December. The object of the exhibition is to encourage the old system of apprenticeship, which thinking Englishmen believe should, in the interest of manufacture, be revived. Anyone serving a genuine apprenticeship can exhibit; various medals, as also a large sum of money, will go in the way of prizes to successful contestants. In the distribution of prizes reference will be had to the time the contestant has worked, to the end of encouraging those who have only been a year or two at their work.

Accounts of the trade depression in England are anything but reassuring. Competition with cheaper labor elsewhere, with no means of protecting themselves against this competition, appears to be the trouble.

"Gas hammers" are being introduced into England, and it seems are making considerable headway in competition with the steam hammer.

Now we learn that efforts are being made to "boom" the Keely motor in England.

AMERICAN MACHINIST

To prevent delays all Communications should be addressed to the Company.

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
J. G. A. MEYER, } Associates.
FRED J. MILLER, }

Special Announcements.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

Subscription.

$2.50 a year in advance, postage prepaid in the United States, Canada and Mexico.
$3.50 a year to Other Countries, postage prepaid.

Advertising.

Transient, 35c. per line, each insertion.
"Business Specials," 50c. a line.

The American News Company,
Publishers' Agents, New York.

The International News Company,
11 BOUVERIE STREET, Fleet Street, LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST, at 14/7 per annum, postage paid.

DEALERS SUPPLIED BY

The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
The Cincinnati News Company, Cincinnati, Ohio.
The Cleveland News Company, Cleveland, Ohio.
The Colorado News Company, Denver, Colorado.
The Detroit News Company, Detroit, Mich.
The International News Company, New York, N. Y.
The Minnesota News Company, St. Paul, Minn.
The Montreal News Company, Montreal, Canada.
The National News Company, New York, N. Y.
The Newark News Company, Newark, N. J.
The New England News Company, Boston, Mass.
The New Orleans News Company, New Orleans, La.
The New York News Company, New York, N. Y.
The Northern News Company, Troy, N. Y.
The Omaha News Company, Omaha, Neb.
The Pittsburgh News Company, Pittsburgh, Pa.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The South West News Company, Kansas City, Mo.
The St. Louis News Company, St. Louis, Mo.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton, Ontario, Canada.
The Union News Company, New York, N. Y.
The Washington News Company, Washington, D. C.
The Western News Company, Chicago, Ill.
The Williamsburgh News Co., Brooklyn, E. D., N. Y.

NEW YORK, NOVEMBER 12, 1887.

CONTENTS.

	PAGE
The Thone Electric Motor	1
Universal Radial Drilling Machine	1
The Exhaust Injector. By W. H. Booth	1, 2
English Standard Pipe Threads	2
Time to Quit	2
A New Water Wheel	2
Fair of the American Institute	2, 3
Mending Broken Castings. By Robert E. Masters	3
Life-Saving Apparatus of Reindeer Hair	3
Modern Locomotive Construction. By J. G. A. Meyer fifty-first paper	4, 5
Twenty-Inch Lever Drill	5
The Gas Meter Dangerous	5
Because it is English	5
Steam Nut and Coffee Roaster	5
Letters from Practical Men: A Growl About Water Columns. By T. T Parker—Prof. Swee 's Spring Roller Problem. By John Coffin—Examination of Engineers. By Q. E. D.—Thickness of Boiler Plates. By W. Barnet Le Van—Exhaust Steam Heating. By H. J. Barron—Hot Air Heating. By William Tod & Co—Initial Stress in Bolts. By W. H. Booth—Still More Initial Strain. By J. W. Thompson—"Careless" Locomotive Engineers. By J. J. Clai —Tail Stock Adjustment. By C. E. Simonds	5, 6, 7
A Pleasant Incident	7
Petroleum Refuse as Fuel on the Elevated Railroads of New York	7
Copying Machine Tools	8
Hiring People to Read Newspapers	8
An Educational Association of Mechanics and Engineers at Poughkeepsie	8
A Good Thing to Investigate	8
Literary Notes	8
Questions and Answers	9
Manufactures	9
Machinists' Supplies and Iron	10

Copying Machine Tools.

While it is generally admitted that a mechanic—a manufacturer—who does nothing better than copy, will never do anything that will amount to much, the real difficulty of copying is hardly appreciated. It is a fact frequently noted as curious that certain localities are famous for years for some special line of business, and that the same kind of business will not flourish elsewhere when the attempt is made to inaugurate it, although the facilities appear to be equally advantageous. A good deal of this may be due to the impossibility of exactly copying anything. Along with the ability to do a good job of imitating must be the ability to so enter into the spirit of the thing as to copy—so to speak—the thoughts of the man who originally furnished the ideas and wrought them into shape.

In a machine, for example, it is the easiest thing in the world to overlook a dozen important points, or to put it another way, it is the hardest thing in the world to see all the important points, or at least, to see them as being important. There is generally a good deal of personality worked into an important piece of mechanism, and the copyist is likely to miss this unless he is enough of an inventor to have devised it himself from the primitive idea, in which case copying is distasteful to him. The most carefully counterfeited bank note contains mistakes and omissions that the expert will detect. And it is almost invariably found that in the copied machine, of anything like a complicated pattern, omissions and mistakes have occurred.

We were reminded of this by the remarks of an American engineer, whose present engagements keep him in Britain, most of the time. He is an expert in the line of machine tools, and was speaking of a recent attempt by a firm there, to bring out an imitation of a well-known American machine tool. In this case part of the trouble seemed to have been in the effort to improve, or at least, to change some of the supposed minor details. The result was that the American engineer, perfectly familiar with the handling of this tool, did not believe he could afford to put one to use if it came as a gift. Some of these details subjected to the improving process had doubtless been worked out in the original, by the exercise of much pains and study, and quite likely were the subject of considerable experiment. A second or a third effort might bring about improvement, but it would probably be, by getting nearer to the original, which it would very likely then be far from equaling.

It is the almost universal practice in copying machine tools, to make some departures from the original. In fact, the commercial necessity for doing this is one of the difficulties of the case. Purchasers distrust mere copies. They feel that somehow more brains have been worked into the original; that there may be some omissions, or an undefined something lacking in the copy. The originator, it is reasoned, knows more about what he devised than the appropriator. Besides this there is the feeling that it is unfair to copy without credit, hence in imitations there are frequently improvements that are far from improving, but that answer very well to talk about. To successfully copy important machines, if changed at all, often requires the efforts of at least as good an inventor in the particular direction required as the originator was, and he will need to spend nearly as much time over it. This would, of course, not be the case when after repeated and extended partial failures, the knowledge of the causes of failure had become common property. And when it comes to improving the designs of competent inventors, it is not commonly done until after a good deal of experience with the original designs. Improvements that are tacked on in the start, to avoid absolute copying, are seldom well thought out, and are more likely to be failures than anything else.

Any young mechanic who has a desire to progress in his chosen vocation, and who is intelligent, knows the importance to himself of a knowledge of mechanical drawing. Whether he expects to ever follow drafting as a business or not, a knowledge of its principles and practice will be of continual advantage, if not indispensable to him. No reader of the AMERICAN MACHINIST can henceforth blame anyone but himself if he fails to acquire a good practical knowledge of this art; for if he is possessed of ordinary ability, and is willing to put in even one-half as much conscientious and painstaking labor in studying the articles on Practical Drawing now running in this paper, as is bestowed upon them by their author, in his efforts to make the principles plain and easily comprehended, he will at the end have not only a thorough and valuable knowledge of drawing, but will have acquired a taste and capacity for such studies, which will be a constant advantage and pleasure to him.

Hiring People to Read Newspapers.

We receive a great many propositions from manufacturers of a great variety of large and small articles, earnestly commending to our notice the tremendous facility with which we could increase the circulation of the AMERICAN MACHINIST, should we arrange to purchase said articles, with view to their wholesale distribution as premiums to subscribers. One of the first planks put in our platform, nearly ten years ago, when the paper was established, was the resolve that, under no circumstances, would we resort to the practice of hiring people to read the AMERICAN MACHINIST. Our platform is still sound, and the seasoning that particular plank has since undergone has served only to make it more substantial. In the future, as in the past, the solid merits of the matter published in our columns will continue to be the only "inducement" offered by us to the reading public.

An Educational Association of Mechanics and Engineers at Poughkeepsie.

A number of mechanics and engineers of Poughkeepsie, N. Y., have taken the iniatory step in the formation of an association for mutual benefit in an educational direction. They have gone so far as to call a meeting, and have elected as president of the association F. H. Treacy, well known to the readers of the AMERICAN MACHINIST as an occasional contributor to its columns. Mr. Treacy is well fitted to help along an association of this kind, and being himself a most industrious student of mechanical matters, is very naturally intensely interested in the new association. This move on the part of the mechanics and engineers of Poughkeepsie is a wise one, and starting with excellent advantages, their success is assured if some hard work is done in the beginning. In the present state of the arts and of society some such organization as the mechanics of Poughkeepsie are starting is virtually a necessity, and the citizens, without reference to vocation, cannot do a wiser thing than give it all the encouragement possible.

A Good Thing to Investigate.

Some of the citizens of Mobile recently resolved themselves into an investigating committee that is likely to be of material benefit to the city. They have been investigating the subject of better means for extinguishing fires in connection with the cost of fire insurance, and they find that by providing the former a good many thousand dollars a year would be saved every year in the latter. The same kind of investigation would reveal the same fact in a good many cities. If the investigation went further it would be found that high insurance and the dread of fire kept business enough away from a city to several times overbalance the cost of decent fire-fighting facilities. Money honestly expended for such purpose is in the interest of every citizen alike, as it affects all alike to keep business or to drive it away. The example set in Mobile is an excellent one to follow. We have in mind cities in certain parts of which insurance rates are about four times what they would be if a few thousand dollars were expended in the direction of fire protection, and this condition very effectually prevents growth, and keeps down the price of property. About the best way for a city to make money is to expend all that is necessary in protecting property from fire.

We must give honor to whom honor is due, and it is apparent that the inventive Yankee has been outdone for once. An Englishman has invented a razor-stropping machine. You put your dull razor into a rest prepared for it, turn a crank, and the thing is done.

The officials of some of the railroads upon which serious accidents have lately happened have acted upon the plainly expressed opinion that the details of such accidents, and the cause, is none of the public's business. In this they make a serious mistake. The privilege of operating these roads is accorded by the public for its own advantage and accommodation, and not for the interests of the managers and stockholders; so far as safety and convenience are concerned the public has the principal interest. This is a fact that railroad managers are constantly losing sight of, and the public apparently sometimes forgets it. When railroad corporations act upon the assumed principle that the people have no right of inquiry they furnish the very best possible argument for interference in the management of their roads. The rights of the public in the matter are infinitely above every other consideration, and railroads exist only to serve the public.

In some of the New England cities, notably in the States of Connecticut and Rhode Island, the citizens are making strenuous exertions to abolish grade crossings of railroads. This is an excellent thing to do; such crossings are inconvenient and dangerous, and ought to be got rid of everywhere as fast as practicable. But there is generally a good deal of unfair abuse of railroads in the matter of doing this. When the roads first entered any cities now properly enough anxious to have the tracks elevated or depressed, the citizens were generally not disposed to question grade crossings. But these have now become, from the growth of the cities, and increased traffic on the roads, more undesirable both to the citizens and to the railroads; a little patience and a disposition to do exactly what is right will abolish them. It is not always an easy matter for even a railroad corporation to advance some millions of dollars at once to elevate or depress their tracks, and such a corporation does not always deserve blame because it does not see its way clear to do so within a few weeks after the demand is made. We do not know that unreasonable demands are made in any of the Eastern cities referred to; we do know of cases where the demands are unreasonable and are delaying the end desired.

Literary Notes.

Elementary Treatise on Analytical Mechanics, is the title of a new work by William G. Peck, Ph.D., LL.D., Professor of Mathematics, Mechanics and Astronomy, Columbia College. The author states in the preface that the work "has been prepared for use as a text-book in the School of Mines, but it is hoped it may find a place in other Colleges and Schools of Science. It is intended to embrace all the principles of Analytical Mechanics that are needed by the student of Engineering, Architecture, and Geodesy."

The higher mathematics as well as the more elementary methods of analysis are used, and at frequent intervals throughout the work, practical examples are given requiring the application of the principles for their solution. The work gives evidence of much conscientious labor in its preparation, and will no doubt meet the approbation of those for whose use it is intended. The work is published by A. S Barnes & Co. New York and Chicago. Price $1.40.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(450) E. L. H., Lawrence, Kan., writes: I have been using river water in my boiler. The water is hard, and I have trouble from lime scale. I can get rain water, which is slightly impregnated with ammonia. Which water do you think would be best? *A.*—The rain water.

(451) Subscriber, St. Louis, asks: 1. Can I cut 11½ threads to the inch with the following gears, the lead screw being 4 to the inch? 20, 28, 32, 40, 48, 56, 72, 80, 88, 96, 104, 112? *A.*—No. The best you can do is to use 32 on the stud and have a gear of 92 teeth for the lead screw. The answer to your second question cannot be given unless we know the shape of object.

(452) A. R. Catasauqua, Pa., asks: Can you inform me where I can find a work containing instructions for measuring the quantity of coal removed from the mines? I want something that will enable me to determine each month the cubic yards removed. *A.*—We do not know of such a book. It seems to us that to obtain cubic yards removed, all you will have to do is to use standard cars of known capacity, and then keep account of the number of full cars taken out of the mine.

(453) B. O., Philadelphia, asks: Can a satisfactory thread of 4″ pitch be cut with a lead screw having four threads to the inch? The screw is to be 3″ diameter, of steel, and I can gear from the large wheel in back gear of lathe. *A.*—By gearing the lathe in the way you speak of, we think you will have no serious difficulty in cutting such screws, provided the lathe is a good one. If the lead-screw train is compound, the job might be done in the regular way without special rigging.

(454) A. W. B., Manchester, N. H., asks: Will you please give me a correct rule for figuring out the amount of coal in a bin? *A.*—Multiply the breadth of the bottom by the length of the bottom in feet, and thus obtain the number of square feet, or the area of the bottom of the bin; multiply this area by the height in feet of the bin, the product will be the number of cubic feet in the bin. Bituminous coal, broken and loose, will weigh 47 to 52 pounds per cubic foot; we believe 50 pounds per cubic foot to be a good average weight to use in this calculation. Hence, multiply the last product found, that is, the number of cubic feet in the bin, by 50; the product will be the weight in pounds of the coal in the bin.

(455) E. G. asks: Will you inform me whether or not a diamond can be burned or melted? And if so at what degree of heat? *A.*—Diamonds such as are used in shops for turning off emery wheels, etc., can be brazed into the holders in an ordinary blacksmith's fire, the heat necessary to melt the brass not being injurious to the diamond. They cannot be melted, and are not consumed at ordinary heats, but if subjected to long-continued and intense heat, such as is produced by a mixture of charcoal and lime, the spirit-lamp and blow-pipe, or large lenses, and at the same time the oxygen of the atmosphere has free access to them, they are slowly consumed. They are then converted into a gaseous substance commonly known as carbonic-acid gas, which is identical with that produced by the combustion of ordinary fuels, and that which is exhaled from the lungs in breathing.

(456) T. C. W., Denver, Col., writes: About last January I saw a receipt for chapped hands in the AMERICAN MACHINIST. I have the numbers for four or five years, but so far cannot find it. I am quite certain it was in one of your numbers, as I used it last year with good results. There was juice of lemon in it, and camphor; please let me know what it was. *A.*—We do not remember the receipt to which you refer, but believe the following will give good results: Wash the hands with fine soap, and before removing the soap, scrub the hands with a tablespoonful of Indian meal, rinsing thoroughly with soft tepid water, using a little meal each time except the last; wipe the hands perfectly dry; then rinse them in a very little water containing a teaspoonful of pure glycerine, rubbing the hands together until the water has evaporated. The glycerine must be pure or it will irritate instead of healing.

(457) J. R., Boston, Mass., writes: I am anxious to know if I am capable of taking charge of a steam plant. I am at present out of work and I seem to feel as if every one in that capacity is more competent than myself; laboring under that opinion I am afraid to apply for a position. Now that you may advise me, I will state my experience. I have fired a stationary boiler 2 years. I have run a Baxter engine and boiler 14 months, and in my last place I had the care of two 50 horse-power Corliss and five 12 horse-power Fitchburg engines; I held this position for five years. I understand the proper method of setting valves; I can use the indicator also; can answer all questions relating to steam boiler, such as the dimensions and the setting of the safety valve as explained in the AMERICAN MACHINIST. I can also engineer the setting of engines or boilers. From the experiences I have stated, you may judge that I will know what to do in cases of emergency. I do not mean to say that I am a machinist but I do my own repairs, including forging, tempering and piping. I left my last place on account of sickness. *A.*—We cannot see any reason why a man having the experience that you say you have, should be afraid to apply for a position. Our advice to you is, that if you have thoroughly regained your health, to wake up, have confidence in yourself, apply for a position, and when obtained, do your work manfully, be afraid of no man, and spend your leisure hours in study and self-improvement.

(458) E. P., Philadelphia, writes: Will you please give me a brief description of the Bessemer process of making steel, or if it requires too much space, will you inform me where I can obtain a full and reliable description of the same? *A.*—Our space in these columns will not permit a full description of the Pneumatic Method of steel making generally known as the Bessemer process; we can only present an outline of the theory of the process. When air is forced in small streams into the lower portion of a vessel filled with molten cast-iron, it ascends rapidly through the mass and becomes further broken up into minute bubbles, setting the liquid metal into rapid circulation, and breaking up its currents into eddies; the air thus comes into contact with every portion of the iron, and attacks all combustible elements in the order of their affinity for oxygen at that high temperature. These elements are principally silicon, carbon, and iron; the sulphur passing off with the other elements to but slight extent, and the phosphorus usually remaining unacted on. The first element to become oxidized is the silicon, of which the pig-iron charged usually carries between 2 and 3 per cent.; when this has been nearly all burned out, and, in the form of liquid silica, floats as a slag upon the upper surface of the mass of molten iron, the carbon is attacked and passes off with other gaseous products. Finally, when the oxygen can find so little of the more readily oxidized elements that its affinities still remain unsatisfied, oxidation of the iron itself begins, and the process should be interrupted. There now remains in the vessel a liquid mass of decarbonized and nearly pure iron, in which but very minute quantities of either carbon or silica are to be found, and which may contain a small amount of iron oxide, if the process has been carried too far. The next step is a recarbonizing operation, by which the desired amount of carbon is added to give the steely quality called for, of manganese to secure the most perfect soundness of ingot, and of silicon to aid in obtaining soundness and to give good welding qualities. The operation might be shortened, and the recarbonization avoided, by stopping the process before the carbon is all consumed, and considerable quantities of cheap steel have been sometimes made in this way. But the rapidity with which combustion proceeds renders the method unreliable and the product of variable quality, and it is found far more satisfactory to complete the decarbonization and then to add a known quantity of carbon. For a description of the operation and illustration of a plant for making the steel, see Materials of Engineering, part II., by Prof. Robert H. Thurston. The above are extracts from this book.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gear Wheels. See Adv., page 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Exhaust Tumbl'g Bbls. Henderson B's., Waterb'y, Ct.

For Improved Cooper Stoves, send to Variety Machine Co., Warsaw, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

For Electric Recording Steam Gauge, write Telemeter Co., 44 Barclay st., New York.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

For Catalogue of 23 hand lathes, planers, etc., write to John Steptoe & Co., Cincinnati, O.

For the best and cheapest four-horse engines, address Peter Walrath, Chittenango, N. Y.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 120 Liberty st., N. Y.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N. Y.

Buy the Excel. Upright Drill; sizes, 20″, 25′, 28″, 32″, 36″ swing. Currier & Snyder Worcester, Mass.

Castings for 2½ x 3″ and 3½ x 4″ vertical engines. Send for circular. F. W Adams, Watertown, N. Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

If you want the best machine shop or boiler-maker's pencils send to F. A. Rich, 23 South Canal street, Chicago, Ill.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Ten 16 in. Engine Lathes, ten 18 in. Eng. Lathes, ten 14 in. Eng. Lathes, ten 15 in. Engine Lathes. Nicholson & Waterman, Providence, R. I.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Quints' Pat. Auto. Steam Engine Governor. Correspondence solicited from mfrs. of Throttle Gov'nr Engines. Leonard & McCoy, 118 Liberty st., N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Nov. 5, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N. Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

The Brown & Sharpe Mfg. Co. have placed at No. 23 South Canal st., Chicago, Ill., a sample line of milling machines and other machinery with S. A. Smith.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.

W. H. Hoffman, consulting engineer, 94 Liberty st., N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

Hot Water Supply. A practical treatise on the fitting of hot-water apparatus for domestic and general purposes. By F. Dye. 82 pages, with 25 illustrations. 12mo., cloth, $1. Send for catalogue. E. & F. N. Spon, 35 Murray st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

MANUFACTURES.

Revelle Bros. will build an ice factory at Florence, Ala.

It is rumored that large steel works will be built at Ensley, Ala.

Brown Brothers will build a new carriage factory at Bristol, Tenn.

A horseshoe nail manufactory will be established at Decatur, Ala.

J. J Bruner is interested in building a cotton mill at Salisbury, N. C.

The Valley City Milling Company will soon erect an elevator at Shelbyville, Mich.

The Southern Cotton Oil Company will probably enlarge their works at Montgomery, Ala.

The planing mill of William Caldwell, at Middletown, Ohio, was recently destroyed by fire.

The Columbus Electric Light Company is the name of a new company at Columbus, Ga.

The foundry of the Linn Iron Works, Birmingham, Ala., recently burned, is being rebuilt.

A rail mill is being built at Jackson, Ohio. The building will be 110x130 feet, brick walls and metal roof.

The Florence Machine Company, Florence, Mass., will resume the manufacture of sewing machines.

The Eaton, Cole & Burnham Company, Bridgeport, Conn., are running their works thirteen hours per day.

The Baxter Electric Motor and Manufacturing Company, Baltimore, Md., has increased its stock to $500,000.

A stock company has been formed to build gas works at Texarkana, Ark. W. L. Whitaker is interested.

Franklin Van Winkle, mechanical and consulting engineer, has removed to offices at 91 Liberty street, New York.

The Penobscot (Me.) Steam Boiler Co.'s works, recently destroyed by fire, will be built upon a much larger scale.

Water-works are talked of at Green Cove Springs, Fla.; Fort Valley, Fla.; Georgetown, Ky.; Hendersonville, N. C., and Bristol, Tenn.

W. P. Robertson and others are interested in forming a company with a capital of $100,000 to establish manufactories at Jackson, Tenn.

J. M. Carpenter, Pawtucket, R. I., has issued an illustrated catalogue of taps, dies, screw plates die stocks, wrenches, and other specialties.

A committee of the citizens of Randolph, Maine, is securing subscriptions to the stock of a company which will build a shoe factory. The town will exempt the property from taxation for a term of ten years.

The Watts-Campbell Company, Newark, N. J., are putting up an addition to their machine shop, and have in contemplation the building of a new foundry. The works are running nights, largely on compound engine work.

The National Pipe Bending Company, New Haven, Conn., inform us that their business during the summer and fall has materially exceeded that of any previous year. They have made recent sales of feed-water heaters aggregating some 6,000 horse-power.

Bowler & Co., of Cleveland, O., are adding a new foundry to their works. It will be devoted exclusively to the casting of chilled car, engine, truck and mining wheels, and steel tired wheels, either with or without axles. The Cleveland Frog and Crossing Works, which they also operate, has enough work on hand to last the balance of the year.

The Jos. Dixon Crucible Co., Jersey City, N. J., have issued a four-page catalogue descriptive of their silica-graphite paint for smoke stack and boiler fronts, and other parts of boilers and heaters exposed to heat. They have excellent testimonials from those who have used this paint.

Business at the Michigan Car Works (Detroit), the pipe foundry and the car wheel works is on the increase, and the companies have orders on hand to keep the men employed all winter. The pay roll at the car works for September was $109,000, or $9,000 more than for August.—*Evening News.*

The Detroit Insulating Insole Company has been organized with a capital stock of $10,000. The stockholders are Benjamin T. Mason, Samuel S. Stephenson, Henry S. Robinson and Arthur W. Kelly. The company will engage in the manufacture of insulated lightning-proof insoles for boots and shoes.

Petroleum, which is used for fuel, caught fire in the Fulton Iron Works at San Francisco recently, and destroyed the machine shops, with much machinery and castings for six steam schooners which had been completed. The loss is about $200,000. The California Car Works, adjoining the iron works, were also burned. Loss, $50,000.

Fay & Scott, Dexter, Maine, write us: Referring to your issue of Oct. 29, you say we have put in an electric light plant. We have not only put in such a plant, but are using it to good advantage, as we are now running 75 hours per week, and at that can hardly keep up with orders for our new 28 and 32 inch engine lathes, and pattern-makers' lathes of the various sizes.

The buildings of the East Buffalo (N. Y.) Iron Works will be completed before the first of January. The main building will be 80x325 feet; machinery building, 50x150; cupola building, 35x52; and boiler house, 40x82. A 28 foot crane in the main building will enable the company to handle the largest castings. Nearly everything in the way of cast-iron will be made at these works.

The Steel Tubular Car Company has been organized, to manufacture cars, railroad supplies, etc., with J. S. Orr, of Philadelphia, as president; Edgard M. Marble, Washington, D. C. vice-president, and John W. Post, New York, secretary and treasurer. The capital stock is to be not less than $5,000,000 nor more than $10,000,000. The company are now looking for a suitable site to erect works.

It is reported that the shoe shop at West Auburn, Maine, now lying idle, together with the tools and machinery therein, will be rented to a responsible party for nominally nothing, if the company will come under obligation to pay the taxes. There is a large engine and boiler on the premises and a windmill at the shore of the lake half a mile distant, by which water is forced through a pipe to feed the boiler.

The Davidson Steam Pump Co., 77 Liberty street, N. Y., has issued a revised catalogue of pumps and pumping machinery. Their list of such machinery is very complete, and well illustrated in the catalogue. The catalogue contains advice to those ordering pumps and a plate of parts for ordering pieces. Also a good deal of useful information in regard to water, tables of areas of circles, mean effective pressure of steam, temperature and weight of steam, friction in pipes, etc., etc.

The new shops of the Dustin & Hubbard Company, Dexter, Maine, occupy three sides of a square—the main shop, which runs parallel with the Messalouskee, being 110 feet long, the other two running westerly at right angles, each 100 feet long. Each of the three buildings is 40 feet wide and 15 feet high in the clear, and no better built shops can be found in the country than these. Light is abundant, there is plenty of room, and the comfort of the workmen has not been overlooked while making the interior convenient in every particular. A basement extends under the whole, where oil, castings, etc., etc., will be stored.

The St. Louis (Mo.) Car Wheel Company, of which R. W. Green is the secretary, with office at Chamber of Commerce building, is erecting extensive new buildings to replace those destroyed by fire, and early next month will be turning out the first wheels from this new establishment. The main foundry building will be 65x445 feet, made from corrugated iron, and having glass skylight throughout its entire length on both sides of the roof. Adjoining on an end will be the building for wheel pits about 60x60 feet. Other smaller and necessary buildings will be added, to make complete those taking the places of the ones burned.—*The Railway Register.*

Machinists' Supplies and Iron.

NEW YORK, Oct. 27, 1887.

Iron—American Pig.—Conservatism seems still to rule the operations of both sellers and buyers, the market being devoid of stimulating features. Consumption appears to be moving along very steadily and fairly, absorbing the output, but the increased production in the lower grades results in an accumulation. The lowest quotation for Standard Lehigh brands of No. 1 X Foundry are $21.00, with $21.50 asked for small lots, but other brands are obtainable at $20.50. We quote No 2 X at $19 to $19.50, and G ay Forge at $17 to $17.25.

Scotch Pig—The market has ruled steady and quiet, and buying is only to cover immediate wants. We quote Coltness, $21.50 to $21.75; Glengarnock, $20 to $20 50; Gartsherrie, $21 to $21.25; Summerlee, $21.25 to $21.50; Eglinton, $19.50; Langloan, $20 50 to 21; Dalmellington, $19 75 to $20, and Clyde, $19 75 to $20.

Antimony.—There has been a moderate demand for Regulus at previous prices; dealers asking 8¾ cents for Hallett's and 9c for Cookson's.

Copper—A slight improvement in the speculative demand has resulted in a firmer market, and a moderate amount of trading has been done at somewhat higher prices than were current last week. About 2 0,000 pounds Lake have changed hands at 10.40 for spot; 10⅝ November, and 10.60 to 10 65 for December. Casting brands are held at 9⅞ to 10⅛ cents.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Situation wanted as draftsman on builders' hardware: practical, with ability to improve. Address Box 69, AM. MACHINIST.

Foundry foreman, 19 years' experience on general machinery, desires to change his present position. Address Box 70, AM. MACHINIST.

An expert draftsman, Norwegian, lately landed, wants a situation, 17 years' tecunical and practical experience. B. Thorsen, 119 Presidentst., Brooklyn

Wanted—Situation as foreman of brass foundry, experienced, fair education, builder's hardware a specialty, ref. Foundryman, care AM. MACHINIST.

Wanted—A blacksmith, experienced in drop and machine forging, to take charge. Address, stating experience and wages expected, Foreman, Box 64, AM. MACHINIST.

Wanted—A partner with from 6 to 8 thousand to take a half interest in a foundry, machine and boiler shops with a good trade already established. Address Thos. Hinds, Malone, N. Y.

Wanted—Situation by first-class managing superintendent of hard and soft rubber works; skilled in every detail in getting out tools, dies, etc. for blown and pressed work. Address Rubber, AM. MACHINIST.

Wanted—Position as Supt. or Foreman by a young man who has held the same for a number of years on fine tools, interchangeable work and automatic machinery. Best of references. W. H. S., 1331 So. 16th St., Phila., Pa.

Mechanical draftsman, neat and rapid, well posted on the different kinds of work connected with the drafting room as well as the shop, wants situation, age 28, any part of United States. Address "S.," Box 152. Cleveland, Ohio.

Position wanted by an A 1 mech. engineer and draftsman; great experience in heavy machinery and iron structural work; highest theoretical abilities; best references: can take charge of drawing room. Apply T. V. R., AM. MACHINIST.

Technical school graduate and practical machinist, age 30, several years' designing, building and improving special machinery, wishes responsible position without much drafting; A 1 references. Address Practical, AM. MACHINIST.

Brass foundry foreman wanted to take charge of a large foundry producing hardware castings of all kinds, including fine ornamental bronze work. Address, stating age, experience, references, and salary expected, Yale & Towne Mfg. Co., Stamford, Ct.

An experienced machinist wishes situation as general foreman in contract shop; will work for an interest in part payment of salary; large experience in marine sawmill and locomotive machinery, no objection to go to Mexico or South America. Address M., AM. MACHINIST.

Wanted—Engagement by a first-class M. E. on or before Dec 1, good draftsman in all brances of mechanics, skilled and accurate in getting out tools and work on the interchangeable system. Pattern foundry and sheet-metal work; capable of managing help. Address Tools, AM. MACHINIST.

MISCELLANEOUS WANTS.

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O

Stationary boat engines, boilers, best, cheapest, 1 to 10 H. P. Washburn Engine Co., Medina, Ohio.

For sale, very cheap, a Roper hot-air engine, three horse-power, in first-class order. Hanzsche & Co., Baltimore, Md.

Wanted—Large second-hand slotting machine, in fair order. Address with full particulars, "Slotter," care AM. MACHINIST.

Wanted—Second-hand press that will cut off ⅜" round steel. One like Farrel Foundry No. 1 Arch Press preferred. Send description and price to Cary, AM. MACHINIST.

A. C. Christensen, 26 Church st., N. Y., mech. and hydraulic engineer, late chf. draftsman at H. R. Worthington. Designs and working drawings of water works, pumps, gen. mach. & pat. drawings.

Tools wanted—One 4 or 4½" cutting off and centering machine; one small vertical boring or chucking machine with turret head for tools; one root blower for 42" cupola. George R. Lombard & Co., Augusta, Ga.

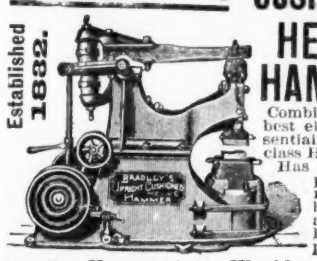
Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. I. A. Weston & Co., Syracuse, N. Y.

Wanted—To purchase an interest in a live manufacturing machine works. One building improved automatic steam engines or specialties in steam engineering preferred. Address with full particulars and price, F. Van Fleet, Williamsport, Penn.

Machine works with capital and proper location desirous of going into the specialty of building first class elevator work of every kind, will be offered exceptional inducements. Address by letter R. C. Smith, late chief eng. Otis Bros., 138, No 1 B'way, N. Y.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER

Established 1832.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the World.

BRADLEY & CO. Syracuse, N.Y.

BRADLEY'S HEATING FORGES.

ESTABLISHED 1832.

For Hard Coal or Coke. Indispensable in all shops to keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.

BRADLEY & CO. Syracuse, N.Y.

TANITE For Saw Mills, Foundries and Machine Shops

Emery Wheels and Grinding Machines. For circulars address

THE TANITE CO., STROUDSBURG, MONROE CO., PA., OR H. A. ROGERS, 19 JOHN ST., NEW YORK.

STEPHENS PATENT VISES.

ONE-HALF TIME and LABOR saved by using this solid, strong, durable, firm-hold, quick-working Lever (Not Screw) Vise. Has improved Taper-Pipe and other attachments. Sold by the trade. Send for circular

TOWER & LYON, 95 Chambers Street, New York. Successors to MELVIN STEPHENS.

—OUR— NEW CATALOGUE OF TOOLS

and Supplies sent free to any address on receipt of Ten Cents in stamps (for postage).

CHAS. A. STRELINGER & CO., Wood Ave., Detroit, Mich.

COMPLETE STEAM PUMP ONLY SEVEN DOLLARS

DEMAND THIS PUMP OF YOUR DEALER. OR WRITE TO US FOR PRICES.

VAN DUZEN'S PATENT

VAN DUZEN & TIFT. SOLE MAKERS CINCINNATI, O.

OFFICES OF

HOWSON & HOWSON,

Philadelphia, 119 South Fourth Street.
New York, Potter Building, 38 Park Row.
Washington, 915 F Street.

THE undersigned, heretofore practicing under the firm name of HOWSON & SONS, will continue, under the firm name of HOWSON & HOWSON, the practice of the law of Patents, Trademarks and Copyrights before the Courts, and the soliciting of Patents and the registration of Trademarks and Labels in the Patent Office.

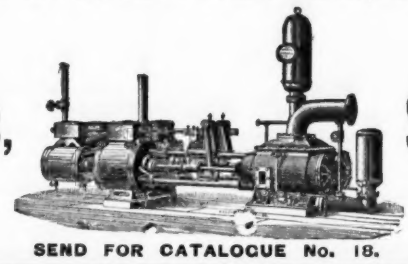
In addition to their offices in Philadelphia and Washington, they have established an office in the City of New York, under the personal charge of Mr. HUBERT HOWSON. Mr. CHARLES HOWSON also will frequently be at the New York Office, and may be consulted there by clients.

CHARLES HOWSON.
HENRY HOWSON.
HUBERT HOWSON.

October 1st, 1887.

THE DEANE STEAM PUMP CO., Holyoke, Mass.

BUILD AND

Water Works,  Steam Pumping

ENGINES MACHINERY.

SEND FOR CATALOGUE No. 18.

IF YOU WANT A SHAPER, PLANER, DRILL, LATHE OR SPECIAL MACHINERY, WRITE TO THE HENDEY MACHINE CO., SEND FOR A CATALOGUE. TORRINGTON, CONN.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.

JAS. HUNTER & SON, North Adams, Mass.

CRESCENT STEEL WORKS.

MILLER, METCALF & PARKIN.

480 PEARL ST. NEW YORK. PITTSBURGH, PA. 64&66 S. CLINTON ST. CHICAGO

F. W. GESSWEIN, 39 JOHN ST. NEW YORK.

MANUFACTURER OF

WALRUS LEATHER BUFFING WHEELS.
MUSLIN and CLOTH BUFFING WHEELS.
FELT POLISHING WHEELS.
WIRE and BRISTLE BRUSHES.

POLISHING AND FINISHING IMPLEMENTS A SPECIALTY.

By the Author of the Moulders' Text-Book.

JOHN WILEY & SONS, 15 Astor Place, N. Y.

PUBLISH

American Foundry Practice,

TREATING OF

Loam, Dry Sand and Green Sand Moulding,

AND CONTAINING

A Practical Treatise upon the Management of Cupolas and the Melting of Iron.

BY THOMAS D. WEST,

PRACTICAL IRON-MOULDER AND FOUNDRY FOREMAN.

Fully Illustrated. 12mo. Cloth. $2.50.

SIXTH EDITION, REVISED, (1887.)

NOTICES.

"One hundred items, that *apprentices* should know and remember, alone are worth the price of the whole work. . . . It is not written with a special view to instructing apprentices, but as *a handbook for men who have learned the trade.*"—*American Machinist.*

RICE'S PATENT

Feed-water Heater and Purifier,

(WITH PUMP COMBINED.)

is guaranteed to be more economical than any other, and users say:

"It is all that you claim."

Send for Descriptive Catalogue.

FRANK M. CLARKSON,

Exclusive Sales Agent, Detroit, Mich.

NICKEL PLATED POCKET LEVEL.

2½-in. 60 cents. 3½-in. 75 cents.

By Mail on Receipt of Price.

PATENT UNIVERSAL SCREW-CUTTING CENTER DEPTH ANGLE AND TWIST DRILL GAUGE.

J. WYKE & CO., Fine Machinists' Tools—4. Boston, Mass—Send for Circular

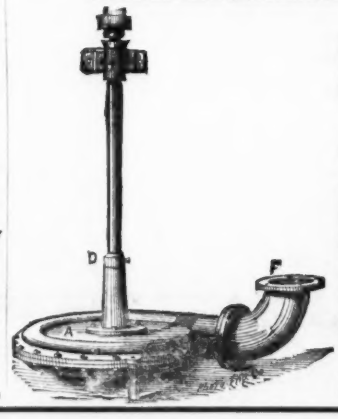
STEAM PUMPS for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar; for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids; for Thick, Volatile, Viscous or Foul Liquids, etc. VACUUM PUMPS of the highest efficiency. FILTER PRESS PUMPS. Air, Gas and Acid Blowers. AIR COMPRESSORS. Etc. BUILT BY

GUILD & GARRISON, Brooklyn, N. Y.

THE CELEBRATED

HEALD & SISCO CENTRIFUGAL PUMPS

Vertical and Horizontal.



No. 8 HOOD, 22 CORTLANDT ST., NEW YORK.

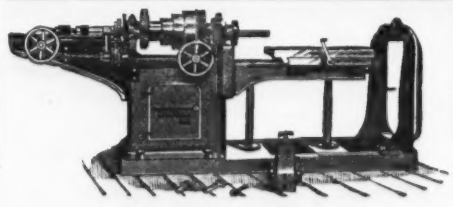
In Writing Mention this Paper.

Sebastian, May & Co.'s Improved Screw Cutting FOOT AND LATHES POWER

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

167 West Second Street, CINCINNATI, O.

OUR NEW 18 in. POWER ENGINE LATHE IS NOW READY.



BETTS MACHINE COMP'Y, WILMINGTON, DEL.,

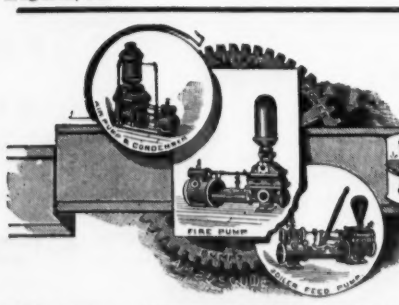
MAKERS OF

Metal-working Machine Tools

OF SUPERIOR QUALITY,

FOR USE IN

MACHINE AND RAILWAY SHOPS.



KNOWLES Steam Pump Works.

93 Liberty St. NEW YORK. | 118 Federal St., BOSTON.

IMPROVED PUMPING MACHINERY | For Every Class of Work | SEND FOR NEW ILLUSTRATED CATALOGUE.

NICHOLSON FILE CO. —SOLE MFRS. OF

FILE CARD.

Files and Rasps

FILE BRUSH.

Having the Increment Cut.

The illustrations herewith presented, exhibit more convenient and durable forms of **File Cleaners** than are usually found, the majority of those in use being rudely devised and troublesome, and we believe for this reason, those of our manufacture will find a ready sale. Machinists and others who have not already given them a trial, will find it to their advantage to order the **File Card** and **File Brush** at once.

Manufactory and Office,

PROVIDENCE, R. I., U. S. A.

THE NEW "GRESHAM" PATENT AUTOMATIC RE-STARTING INJECTOR

"Invaluable for use in Traction, Farm, Portable Marine and Stationary Boilers of all kinds. No handles required. Water supply very difficult to break. Capability of re-starting automatically, immediately after interruption to feed from any cause."

SEND FOR CATALOGUE. **RELIABLE AND CHEAP.**

Sole Manufacturers in the United States and Canada.

NATHAN MANUFACTURING CO.

92 & 94 LIBERTY ST., - - - NEW YORK.

Established in 1874.

CLEVELAND TWIST DRILL CO.

24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.

WHY THIS IS PUT HERE!

For the reason that if you are interested in raising water or other liquids by steam power, we wish to call your attention to the

NEW PULSOMETER,

THE CHEAPEST AND BEST STEAM PUMP IN THE MARKET. PRICES LOWER THAN ANY OTHER.

More Efficient, Simple, Durable, and more Economical, both as to running expenses and repairs, than any other Steam Pump.

Call or write for our new 96 page Illustrated Descriptive Book containing Full Particulars, Reduced Net Prices, and hundreds of A-1 Testimonials. Mailed Free.

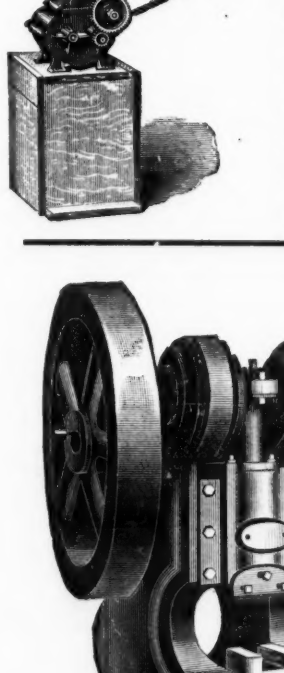
PULSOMETER STEAM PUMP CO., 83 JOHN STREET, N. Y.

CHARLES MURRAY
ENGRAVER ON WOOD
58 ANN ST. NEW YORK.

ECONOMICAL STEAM BOILERS
A SPECIALTY.
SEND FOR PRICES **Pond Engineering Co.** ST. LOUIS, MO.

ROOTS' NEW ACME HAND-BLOWER.

For Blacksmiths, etc. Slow Speed, Positive Blast. Is Durable Compact and Cheap, also Portable Forges, Tuyere Irons and Foundry Blowers.



P. H & F. M. ROOTS, Mfrs.
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., } 22 CORTLANDT ST., NEW YORK.
COOKE & CO., Selling Agts., }
Please Mention This Paper.

Buffalo Cupola & Forge Blowers.

WARRANTED Superior to any other make.

All sizes and styles of every class of work.

BUFFALO FORGE CO.
BUFFALO, N. Y.

Send for Catalogue and prices.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers and Importers,
810 Walnut St., Philadelphia.

☞ Our Catalogue of Practical and Scientific Books, 96 pages 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

BEAUDRY'S DUPLEX Power Press

COMBINING

PRESS, SHEARS AND PUNCH.

BEAUDRY & Co.

(Formerly of Beaudry's Upright Power Hammer.)

SOLE MANUFACTURERS.

Also Manufacturers of

HARD COAL HEATING FORGES.

OFFICE.

Room 4, MASON BUILDING,

70 KILBY STREET,

Boston, Mass.

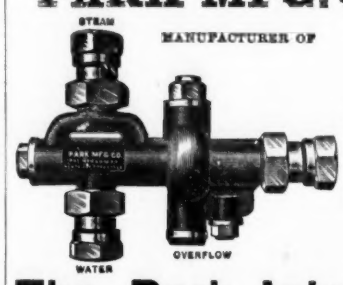
REDUCED PRICES OF LECOUNT'S STRAIGHT TAIL DOG.

To be driven from a Stud in the Face Plate.

No.	INCH.	PRICE	No.	INCH.	PRICE
1	¾	$0.60	10	2¼	$1.35
2	⅞	.70	11	2⅜	1.45
3	1	.70	12	3	1.60
4	1⅛	.80	13	3⅛	1.80
5	1¼	.80	14	4	2.10
6	1⅜	.95	15	4⅛	2.75
7	1½	.95	16	5	3.25
8	1¾	1.10	17	5⅛	4.00
9	2	1.30	18	6	5.00
1 Set to 2 in.		7.80	Full Set		31.10

C. W. LeCOUNT, South Norwalk, Conn.

PARK MFG. CO.



34 Beach Street, Boston, Mass.

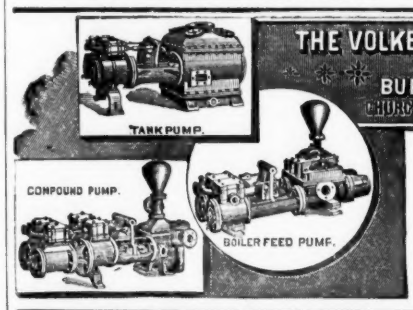
The Park Injector,

EJECTORS AND JET APPARATUS.

T. SHRIVER & Co's IRON FOUNDRY,

333 East 56th St., NEW YORK.

Contracts Solicited for Machinery Castings in regular supply.



THE VOLKER & FELTHOUSEN M'F'G. CO.

MANUFACTURERS OF

BUFFALO DUPLEX STEAM PUMPS.

CHURCH, BIRD'S ALLEY & MECHANIC ST. BUFFALO N.Y.

For Sale at Factory Prices by

A. Aller, New York; S. C. Nightingale & Childs, Boston; Henry I. Snell, Philadelphia; Thos. J. Bell & Co., Cincinnati; Shaw, Kendall & Co., Toledo; The George Worthington Co., Cleveland; Goulds & Austin, Chicago; Kennedy & Pierce Machinery Co., Denver, Col.; Sheriff & Ashworth, Pittsburgh, Pa.; Jos. Baur, Manistee, Mich.; Jas. Jenks & Co., Detroit, Mich.; Wickes Bros. East Saginaw; Adolf Leitelt, Grand Rapids; E. F. Osborne & Co., St. Paul, Minn.; Rundle, Spence & Co., Milwaukee, Wis., Joshua Hendy Machine Works, San Francisco; Flynn & Emrich, Baltimore, Md.; Forbes Liddell & Co., Montgomery, Ala.; Bailey & Lebby, Charleston, S. C.; Pond Engineering Co., St. Louis and Kansas City, Mo.; O. B. Goodwin, Norfolk, Va.; Columbus Supply Co., Columbus, O.

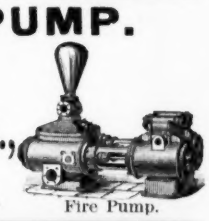
HALL DUPLEX PISTON PUMP.

Send for New Catalogue.

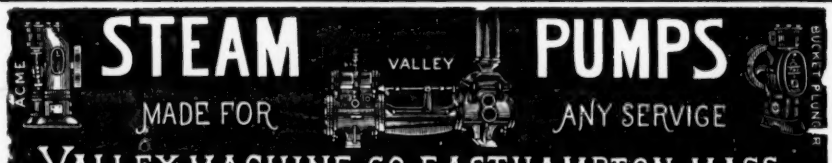
Boiler and Pump combined.

HALL STEAM PUMP CO.,

91 Liberty St., New York.


Fire Pump.

STEAM PUMPS

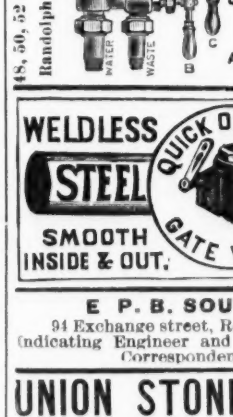


MADE FOR ANY SERVICE

VALLEY MACHINE CO. EASTHAMPTON, MASS.

THE DUPLEX INJECTOR

THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

JAMES JENKS & CO.,
Detroit, Mich.

— AGENT, —

ARTHUR APPLETON,
45 Cortlandt St., New York.

Fitchburg Machine Works.

Manufacturers of

METAL-WORKING MACHINES.

OFFICE AND WORKS,

13 to 21 MAIN STREET,

Fitchburg, Mass.

Send for Catalogue (E.)

WELDLESS STEEL TUBES

QUICK OPENING GATE VALVE

COLD DRAWN

SMOOTH INSIDE & OUT.

JOHN S. LENG.
4 Fletcher St N.Y.

E. P. B. SOUTHWORTH,
94 Exchange street, Rochester, New York.
(ndicating Engineer and Mechanical Draftsman
Correspondence solicited.

NEW SELF-SETTING PLANE.

ASK YOUR DEALER FOR IT.

Sample sent as per Circular.

Gage Tool Co., Vineland, N. J.

UNION STONE COMPANY,

38 & 40 HAWLEY ST., BOSTON, MASS.
36 JOHN ST., NEW YORK.

B. GRINDING MACHINE.
1" Shaft. Takes Wheels to 14" diameter. Countershaft with hangers or in machine. Is specially adapted to light work in machine shop, tool grinding, etc.

EMERY-WHEEL GRINDING MACHINERY, EMERY WHEELS AND TOOLS.

MACHINERY FOR POLISHING WHEELS, POLISHING BELTS, AND POLISHING BUFFS, AND ALL SUPPLIES PERTAINING THERETO.

ELECTRO-PLATERS' SUPPLIES.

WORTHINGTON —HIGH DUTY— Pumping Engine

—FOR—

WATER WORKS

OVER 100,000,000 DUTY

—GUARANTEED—

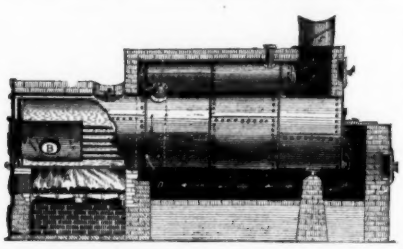
SEND FOR RECENTLY ISSUED PAMPHLET

HENRY R. WORTHINGTON

NEW YORK CITY.

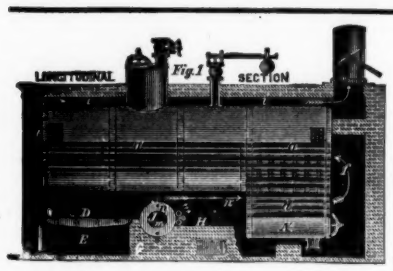
THE THIRD
HARRISON SAFETY BOILER,
IS NOW BEING ERECTED AT THE
STEVENS INSTITUTE OF TECHNOLOGY,
HOBOKEN, N. J.,
Where they have been in constant service
DURING THE PAST SEVENTEEN YEARS.

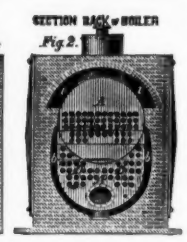
"STEAM" A VALUABLE BOOK for EVERY STEAM USER AND ENGINEER
PUBLISHED FOR FREE DISTRIBUTION, BY
THE BABCOCK & WILCOX CO.
Manufacturers of
WATER-TUBE BOILERS,
107 Hope St., GLASGOW. *30 Cortlandt St., NEW YORK.*



Over fifty years' competition has proven this system of boiler to be the best in every respect. The LOWE BOILER, with all improvements, is the simplest, best wearing, and most economical of any kind of fuel.

Send for description and histories of Steam Boilers and Feed Water Heaters (free) to
BRIDGEPORT BOILER WORKS, Bridgeport, Conn.





The Bate STEAM GENERATOR

Generates steam rapidly and economically. Constant circulation of water. Easily Cleaned. Furnace produces perfect combustion. Best evaporative duty; Material and workmanship A1. Large number in use.

WM. T. BATE & SON,
Sole Manufacturers,
CONSHOHOCKEN, PENNA.

THE WAINWRIGHT
Corrugated Tube Exhaust Feed-Water Heater
DELIVERS WATER TO THE BOILER
At 200° to 210° Fahr., and without back pressure on Engine.

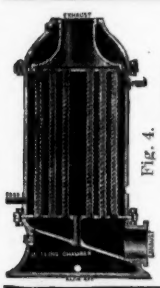


Fig. 4.

Manufactured by
THE WAINWRIGHT M'F'G COMPANY,
65 and 67 Oliver Street, Boston, Mass.

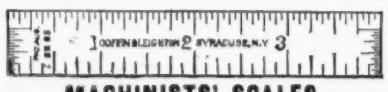
MACHINERY, TOOLS and SUPPLIES.
Complete Outfits for
MACHINISTS, BLACKSMITHS, MODEL MAKERS, JEWELERS, ETC.
Lathes, Planers, Shapers, Drill Presses, Emery Grinders, Milling Machines, Bolts, Screws, Washers, Belting, Packing, Waste, Twist Drills, Taps, Reamers, Cold Rolled Shafting, Hangers, Files.
SEND FOR ILLUSTRATED PRICE LIST OF METAL-WORKERS' TOOLS, ALSO WOOD-WORKERS'.
TALLMAN & McFADDEN, 1025 MARKET STREET, PHILADELPHIA.

COILS & BENDS
—OF—
IRON,
BRASS and
COPPER
PIPE.
ALL STYLES.
THE
NATIONAL
Pipe Bending Co.
NEW HAVEN, CONN.

THOS. H. DALLETT & CO.
13th & Buttonwood Sts., PHILA. PA.
Manufacturers of
PATENT
Portable Drilling Machines,
VERTICAL DRILLS,
Radial Drills, Multiple Drills,
HAND DRILLS.
SEND FOR ILLUSTRATED CATALOGUE.

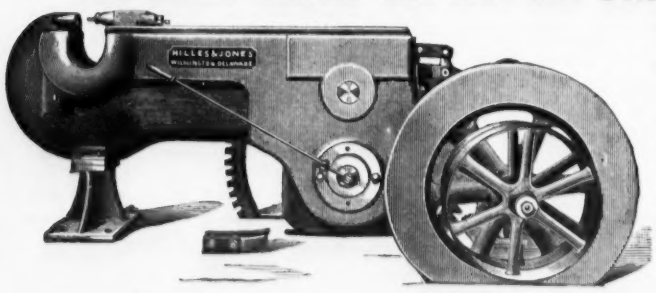
PECK'S PAT. DROP PRESS.
BEECHER & PECK. NEW HAVEN CONN.

DROP FORGINGS OF IRON OR STEEL
BEECHER & PECK, NEW HAVEN CONN.



MACHINISTS' SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST
COFFIN & LEIGHTON, SYRACUSE, N. Y.

Horizontal Flange Punch
FOR BOILER MAKERS' AND IRON SHIP BUILDERS' USE.



Punches, Flanges of all shapes, and Bent Angle Iron from either side.

FIVE SIZES.

Depth of Jaws from 6" to 42",

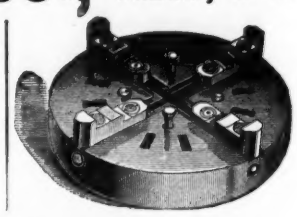
MADE BY
HILLES & JONES,
Wilmington, Del.

The Original Unvulcanized Packing
CALLED THE STANDARD—As it is the Packing by which all others are compared.
Accept no packing as JENKINS PACKING unless stamped with our "Trade Mark."
JENKINS BROS { 71 JOHN STREET, N. Y. / 105 MILK STREET, BOSTON. / 13 SOUTH FOURTH ST., PHILA. / 54 DEARBORN STREET, CHICAGO.

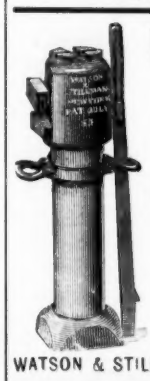
WESTCOTT CHUCK CO., ONEIDA, N. Y.
MANUFACTURERS OF
LATHE and DRILL CHUCKS
SEND FOR CATALOGUE.

GEARED CHUCKS.
Jaws Reversible.

Diameter.	Capacity.
5 inch.	5 inch.
7⅛ "	7⅛ "
10⅛ "	10⅛ "
13 "	13⅛ "
15¼ "	17 "
18 "	19¾ "
21 "	25½ "
24 "	28 "



VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.



Hydrostatic Machinery
PRESSES,
PUMPS,
PUNCHES,
Accumulators,
JACKS,
VALVES,
FITTINGS,
Vault Elevators, &c. &c.
WATSON & STILLMAN, 204-210 East 43d St., N. Y.

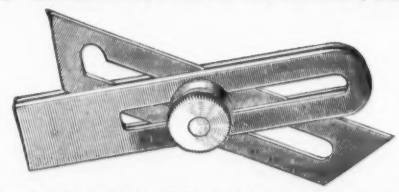
"THE" SWEETLAND CHUCK
M'F'D BY THE HOGGSON & PETTIS M'F'G CO.
EST. 1849 NEW HAVEN, CT.

UNIVERSAL! INDEPENDENT! ECCENTRIC!
UNEQUALED IN STRENGTH, ACCURACY, SIMPLICITY OF CONSTRUCTION.
72 PAGE CATALOGUE AND PRICE LIST MAILED ON APPLICATION.

"CUSHMAN" CHUCKS
Are guaranteed to be right in all respects. Ask to see them at your dealer's, or write direct to the factory. Respectfully,
THE CUSHMAN CHUCK CO.,
HARTFORD, CONN.

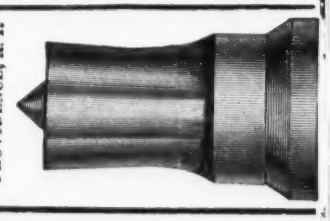
T. P. FARMER,
DESIGNER AND INVENTOR
OF SPECIAL TOOLS AND APPLIANCES.
Mechanical Engineering.
Particular attention given to Perfecting Inventions for parties intending to apply for patents.
Address care Am. Machinist, N. Y. City.

SEND for Illustrated Price List of *Fine Tools*, manufact'd by Standard Tool Co., Athol, Mass.



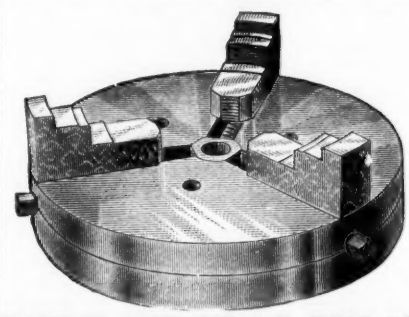
Any Tool we make will be sent by mail or express to any address, all charges prepaid, on receipt of price.

L. P. RICHARDS,
Punches and Dies
PROVIDENCE, R. I.

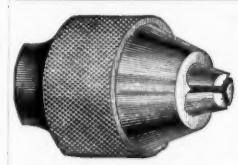


"Twenty Years with the Indicator."—2 vols., $3.00. By THOS. PRAY, JR., C. & C. E. and C. & M. E. Six thousand sold. J. Wiley's Sons, 15 Astor Place, N. Y., or Thos. Pray, Jr., P. O. Box 2728, Boston, Mass.

ESTABLISHED 1851.
The Horton Lathe Chuck.



THE E. HORTON & SON CO.
Canal St., Windsor Locks, Conn., U. S. A.

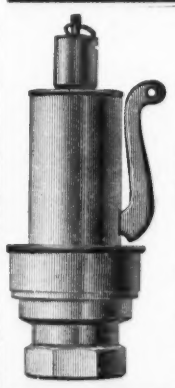


Almond Drill Chuck,
Sold at all Machinists' Supply Stores.
T. R. ALMOND,
83 & 85 Washington St., Brooklyn, N. Y.

L. S. STARRETT,
Manufacturer of
FINE TOOLS
ATHOL, MASS.
SEND FOR FULL LIST.

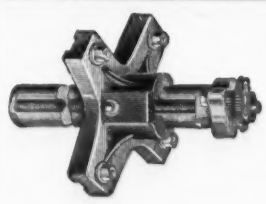
W. C. YOUNG & CO., Worcester, Mass. Manufacturers of
Engine Lathes, Hand Lathes,
FOOT POWER LATHES, SLIDE RESTS, Etc.

FLUOR SPAR The Best *Foundry* **FLUX.**
SEND FOR LIST OF USERS.
Evansville Spar Mining Co., EVANSVILLE, IND.



CALUMET AND HECLA MINE,
CALUMET, MICH.,
June 14th, 1887.
J. E. LONERGAN & Co.,
211 Race St., Phila., Pa.:
We have received and applied your Pop Safety Valve. Up to this date it is giving excellent satisfaction. It holds the steam to within one pound of the working pressure. If it holds out as well as it started off, we will find it to be the best valve the writer has ever used. We shall undoubtedly require more before long.
L. S. WOODBURY,
2D ASS'T SUP'T.

PATENTS
R. G. DU BOIS, Patent Att'y, 916 F St., Washington, D. C. Good references. Send for pamphlet.



BORING BAR FOR LATHE.
BUILT ANY SIZE REQUIRED.
Has Hardened Steel Centers, Constant Feed of Cut Gears, Steel Feed Screw and Nut, Accurately Ground, First-class Lathe Tool.
PEDRICK & AYER,
PHILADELPHIA, PA.

MORSE TWIST DRILL AND MACHINE COMPANY, New Bedford, Mass

Manufacturers of **Morse Patent Straight-Lip Increase Twist Drills.**

Solid and Shell Reamers, Beach's Patent Self-Centering Chuck, Bit Stock Drills
DRILL GRINDING MACHINES, MILLING CUTTERS AND SPECIAL TOOLS TO ORDER.

STEEL BALLS
FOR ANTI-FRICTION BEARINGS, OF BEST CAST STEEL.
HARDENED GROUND & BURNISHED.
3-16" to 3" Diameter.
Samples and Prices on application.
SIMONDS ROLLING-MACHINE CO.
FITCHBURG, MASS.

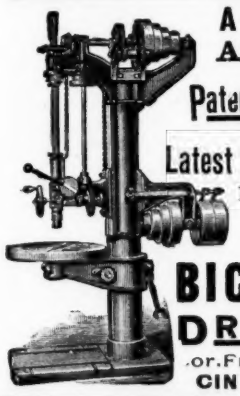
WALKER'S TOOL HOLDER.

For holding drills and reamers for lathe work. Prevents breaking or slipping. Can also be used for drilling and reaming holes by hand, and for reaming holes under drill presses, etc. Made with double handle, when required.
WALKER MFG. CO.
CLEVELAND, OHIO.

A Complete Cutting-off Machine, $4.00.
Larger ones which cut to 2 in. $8.00.
S. ELLIOTT, Newton, Mass.

S. ASHTON HAND MFG. CO.,
Toughkenamon, Chester Co., Pa.
MAKERS OF FIRST-CLASS
ENGINE LATHES
Are now in position to put on the market,
14" ENGINE LATHES OF NEW DESIGN,
guaranteed to be equal in material, design and workmanship to the best ever offered.

UPRIGHT DRILLS

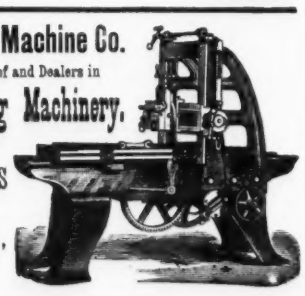


A SPECIALTY.
ALL SIZES
—WITH—
Patent Quick Return
—AND—
Latest Improvements.
For Catalogues and Prices, address,
BICKFORD DRILL CO.
cor. Front & Pike Sts.
CINCINNATI, O.

Do You Use Glue?
Improved Steam Glue Heaters
without Joints, and therefore free from leakage. Furnished with Plain Iron, Enameled Iron or Copper Pots. For Pattern Makers, Cabinet Makers, Joiners, Bookbinders, in fact, all who use Glue. Please mention this paper, and send for Price List to makers. Made in nineteen different styles.

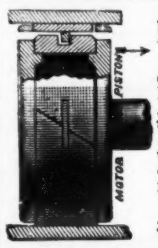
PANCOAST & MAULE,
245 South Third Street,
PHILADA, PA.
BUILD THESE

L. W. Pond Machine Co.
Manufacturers of and Dealers in
Iron Working Machinery.
IMPROVED
IRON PLANERS
A Specialty.
140 Union St., Worcester, Mass.

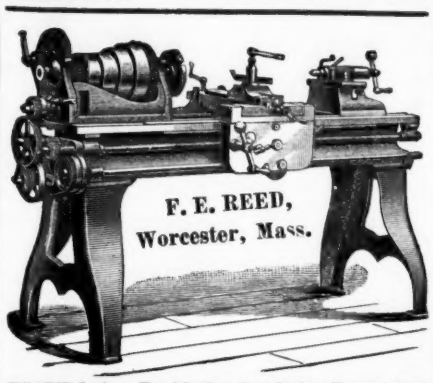


NEW YORK AGENTS.
FRASER & ARCHER,
NEW AND SECOND-HAND MACHINERY,
SHAFTING, HANGERS AND PULLEYS,
121 CHAMBERS STREET.

CARY & MOEN
STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS.
234 W. 29 ST. NEW YORK CITY



Brandon's Piston Ring Packing
Perfectly balanced against undue pressure in all directions. Preserves both cylinder and rings. Allows no waste by either friction or leakage. Call and see working model, expressly made to demonstrate advantages claimed. For packing or shop rights, address
JAMES BRANDON,
390 Eleventh Ave., New York.

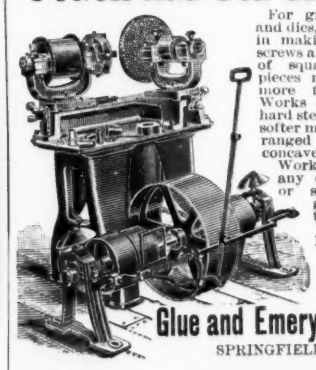


ENGINE Lathes, Hand Lathes, Foot Lathes, Upright Drills and Milling Machines. Agents, MANNING, MAXWELL & MOORE, 111 LIBERTY STREET, NEW YORK.

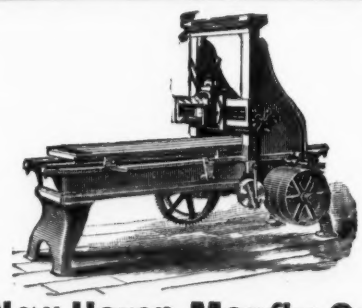
SHAPING MACHINES
FOR HAND AND POWER.
6", 8" and 10' Stroke.
Adapted to All Classes of Work to their Capacity.
Circulars Furnished.
BOYNTON & PLUMMER,
WORCESTER, MASS.

DIXON'S
SILICA GRAPHITE
BOILER-FRONT AND SMOKE STACK PAINT.
WILL LAST FOR YEARS
JOS. DIXON CRUCIBLE CO.
JERSEY CITY, N. J.

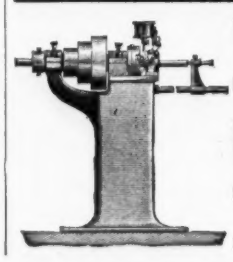
PUNCH AND DIE GRINDER.



For grinding punches and dies, such as are used in making bolts, rivets, screws and a large variety of square or circular pieces requiring one or more finished faces. Works equally well on hard steel, chilled iron or softer metals. Can be arranged to grind convex, concave or flat surfaces. Work can be ground to any desired thickness or several pieces ground to same thickness. Write for Circular.
Springfield Glue and Emery Wheel Co.,
SPRINGFIELD, MASS.

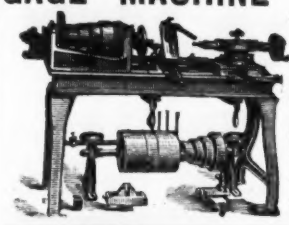


New Haven Manf'g Co.
NEW HAVEN, CONN.
IRON-WORKING MACHINERY.



William Barker & Co.
Manufacturers of
IRON AND BRASS
—WORKING—
MACHINERY
140 & 142 E. Sixth Street,
N'r Culvert, **Cincinnati, O.**
Send for circulars and prices.

GAGE MACHINE WORKS,



Waterford, N. Y.
Manuf'r's of
FOX, TURRET AND SpeedLathes AND Brass Finishers' TOOLS.

THE BACKUS WATER MOTOR

SUPPLIES FROM HYDRANT PRESSURE the cheapest power known. Invaluable for blowing Church Organs, running Printing Presses, Sewing Machines in Households, Turning Lathes, Scroll Saws, Grindstones, Coffee Mills, Sausage Machines, Feed Cutters, Electric Lights, Elevators, etc. It needs little room, no firing up, fuel, ashes, repairs, engineer, explosion, or delay, no extra insurance, no coal bills. Is noiseless, neat, compact, steady; will work at any pressure of water above 15 lb.; at 40 lb. pressure has 4-horse power, and capacity up to 10-horse power. Prices from $15 to $300. Send for circular to
THE BACKUS WATER MOTOR CO., Newark, N. J.

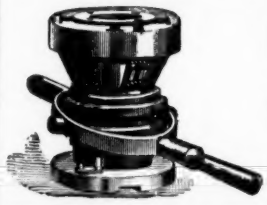
D. SAUNDERS' SONS
MANUFACTURERS OF THE ORIGINAL
TRADE **I. X. L.** MARK.
Pipe Cutting and Threading Machine.
BEWARE OF IMITATIONS.
None genuine without our Trade-mark and Name.
STEAM AND GAS-FITTERS' HAND TOOLS.
Pipe Cutting and Threading Machines, for Pipe Mill Use, a Specialty.
and for Circulars. **YONKERS, N. Y.**

STEEL CASTINGS
From 1-4 TO 15,000 lbs. WEIGHT.
True to Pattern, sound, solid, free from blow-holes and of unequaled strength.
Stronger and more durable than iron forgings in any position or for any service whatever.
40,000 CRANK SHAFTS and 30,000 GEAR WHEELS of this steel now running prove this.
Cross-Heads, Rockers, Piston-Heads, etc., for Locomotives.
STEEL CASTINGS of every description.
Send for Circulars and Prices to
CHESTER STEEL CASTINGS CO.,
Works, Chester, Pa. Office, 407 Library St., Philadelphia, Pa.

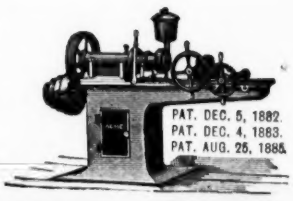
WM. BERKEFELD'S FOSSIL MEAL COMPOSITION.
THE BEST

Non-Conducting Covering for Steam Pipe and Boilers.
The only genuine Fossil Meal. Sold in bags of 110 lbs. each. Beware of imitations. Send for circulars.
Fossil Meal Co., 48 Cedar St., N. Y.
A. GIESE, Sole Proprietor.

Trade-mark
W. B. C.



ACME MACHINERY CO.,
CLEVELAND, OHIO.
Manufacturers of
"ACME"
Single & Double **Automatic Boltcutters,**
Cutting from 3-8 in. to 6 in. diameter.
Also Separate Heads and Dies.
Send for Catalogue and Discounts.
Agents, Manning, Maxwell & Moore, New York.



Sterling Emery Wheel Co.
—L. BEST, Manager,—
MANUFACTURERS,
West Sterling, Mass.
AGENCIES:—Frank J. Scott, Boston, Mass; New York Supply Co. L't'd., N.Y.; E. L. Hall & Co., Philadelphia, Pa.; Brown & King, Atlanta, Ga.; Taylor Bros., Pittsburgh, Pa.; Columbus Supply Co., Columbus, O.; Marinette Iron Works, Chicago, Ill.; Ripley & Bronson, St. Louis, Mo.

WORCESTER MACHINE SCREW CO.

Manufacturers of Set, Cap and Machine Screws, Studs, etc.

MACHINERY
For Reducing and Pointing Wire
Especially adapted to pointing wire rods and wire for drawing.
For Machines or information, address the manufacturer,
S. W. GOODYEAR, Waterbury, Ct.

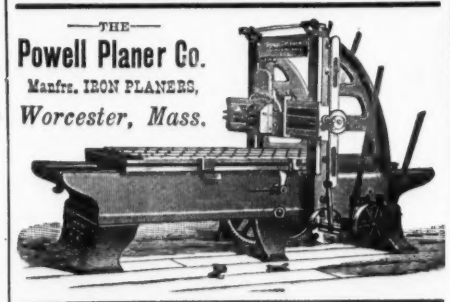
WOOD-WORKING MACHINERY

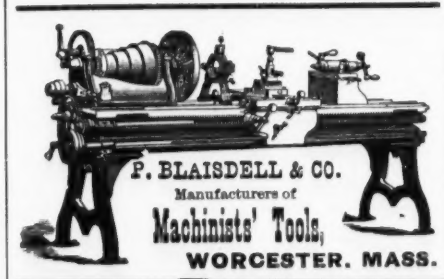
For Planing Mills, Furniture, Chair and Cabinet Factories, Cabinet Works and General Wood-Working. Send Stamp for Illustrated Catalogue to
Rollstone Machine Co.
45 WATER ST, FITCHBURG, MASS.

UNIVERSAL RADIAL DRILL CO.

RADIAL DRILLING MACHINES
THREE DESIGNS. SIX SIZES.
EMBODY ALL DESIRABLE FEATURES
PRICES $450.00 & UPWARD
ADDRESS UNIVERSAL RADIAL DRILL CO
CINCINNATI. O. U.S.A.

—THE—
Powell Planer Co.
Manfrs. IRON PLANERS,
Worcester, Mass.





Manufacturers of
Machinists' Tools,
WORCESTER, MASS.

FORBES & CURTIS
66 JOHN ST., Bridgeport, Ct.,
MANUFACTURERS OF
The Forbes Pat. Die Stocks,
Power Pipe Cutting and Threading Machines, Cutting-off Machines, Ratchet Drills, Special Machinery, etc., etc.
WRITE FOR CATALOGUE
Mention Paper.

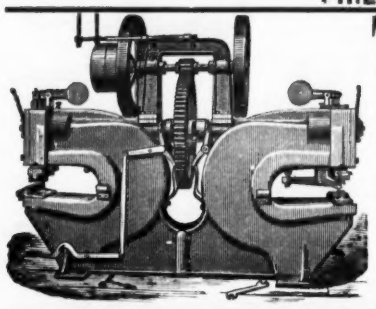
BEVEL GEARS,
Cut Theoretically Correct.
For particulars and estimates apply to
BREHMER BROS.
Machinists,
440 N. 12th St., Philadelphia, Pa.

THE MASON REDUCING VALVE
GIVES SATISFACTION WHEREVER USED
OFFICE 22 CENTRAL ST. BOSTON. MASS.
JENKINS BROS. AGENTS, New York & Chicago

HIGH SPEED POWER TRAVELING CRANES.

We are now prepared to build HIGH SPEED POWER TRAVELING CRANES for any capacity of load, any length of runway and any width of span, with one or with two trolleys on the bridge. These trolleys to work either slow or fast, together or independently, in like or in opposite directions, horizontally or vertically, while the bridge can be traversing slow or fast at the same time in either direction. The speeds of bridge on runway are *100 feet and 200 feet per minute;* the speeds of trolleys on bridge are *50 feet and 100 feet per minute;* and there are four hoisting speeds *of 5, 10, 20 and 40 feet per minute;* all can be varied quickly without the least shock or jar from zero to maximum or to any intermediate speed. *The load is always automatically sustained, thus avoiding absolutely the great danger and anxiety which are inseparable from the use of those Cranes which require the operator to apply the brake.* We have had one of these Cranes of 26 tons capacity in constant use in our foundry for nearly two years, and we offer them with full confidence for the greatest range of service. We invite the correspondence of parties interested in the subject.

WM. SELLERS & CO., Incorporated,
PHILADELPHIA, PA.

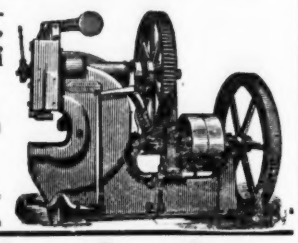


THE LONG & ALLSTATTER CO. Hamilton, OHIO.

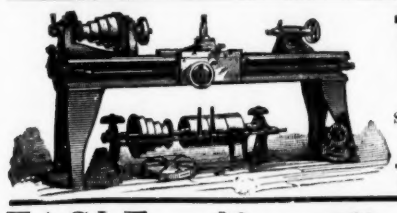
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven

Punches and Shears.

Over 300 Sizes.
ALSO,
Power Cushioned Hammer.



Send for new Catalogue



16″ Engine Lathes

NEW DESIGNS—LATEST IMPROVEMENTS—
SIMPLICITY OF CONSTRUCTION—WORKMANSHIP OF THE BEST.
Send for Cuts and Prices.

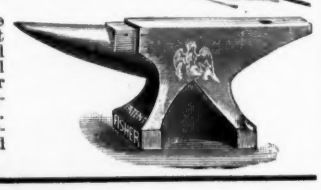
The Muller Machine Tool Co. Eighth & Evans Sts. CINCINNATI, O.

EAGLE ANVIL WORKS,

Trenton, N. J.

The **Fisher Double Screw Leg Vise.**—Warranted stronger grip than any other Vise. Always parallel and cannot be broken.

Send for Circulars.



The **Eagle Anvil.**—Best Cast Steel Face & Steel Horn. Better than any English anvil. Fully warranted and lower price.

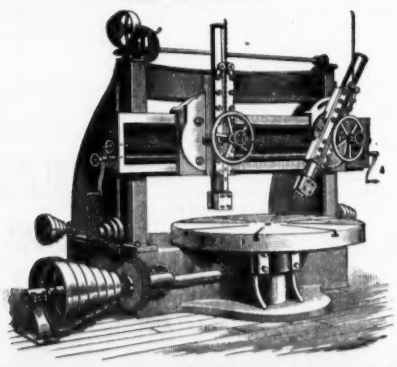
PATENT BINDERS.

—For American Machinist, to hold 52 issues. Price $1 each, by mail or express to any part of the United States.

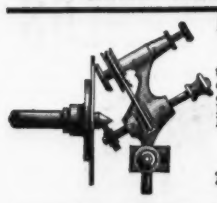
AMERICAN MACHINIST PUB'G CO.,
96 FULTON STREET, NEW YORK.

H. BICKFORD,

MANUFACTURER OF



BORING AND TURNING MILLS.
LAKE VILLAGE, N. H.



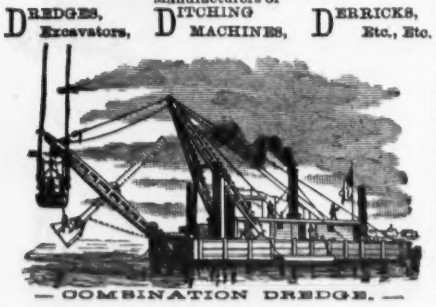
Friction Driven Center Grinder.

A neat, simple and cheap tool to true up centers, will grind centers up quicker than they can be annealed, turned and hardened, will go on any size lathe without any adjustment.

Send for descriptive circular

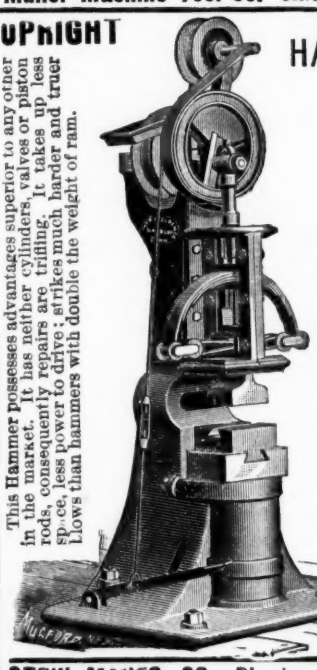
ENERGY M'F'G CO.
1115 to 1123 S. 15th Street,
PHILADELPHIA, PA.

OSGOOD DREDGE CO., - ALBANY, N. Y.
RALPH R. OSGOOD, Pres. JAMES H BLESSING, Vice-Pres.
JOHN K. HOWE, Secretary and Treasurer.
Manufacturers of
DREDGES, Excavators, DITCHING MACHINES, DERRICKS, Etc., Etc.



—COMBINATION DREDGE.—

UPRIGHT POWER HAMMER.



This Hammer possesses advantages superior to any other in the market. It has neither cylinders, valves or piston rods, consequently repairs are trifling. It takes up less space, less power to drive; strikes much harder and truer blows than hammers with double the weight of ram.

It can be worked to strike good alternate blows on 3-inch and 4-inch bar when a 100-pound hammer is used, and can be used on die work to a far greater advantage than any other hammer known. Manufactured by the

R. A. BELDEN CO., Danbury, Conn.

STOW MANFG. CO., Binghamton, N. Y.

FLEXIBLE SHAFTS,
TAPPING and
REAMING MACHINES,
Portable Drills,
ALSO FLEXIBLE
BORING MACHINES

For Ironing Carriages and Wagons; Boring for Pinning Sash, Doors and Blinds, also for Stair Work.

The Armstrong Mfg. Co.

BRIDGEPORT, CONN.

Water, GAS AND STEAM Fitters' Tools.

STOCKS AND DIES FOR PIPE, BOLTS AND BRASS PIPE WRENCHES, PIPE VISES, ETC.

—— SEND FOR CATALOGUE. ——

LATHES IN STOCK.

One 32″ x 20′ second hand, a bargain.
One 36″ x 16′ triple geared, very heavy, new.
One 32″ x 18′ " " " " "
One 42″ x 18′ " " " " "

THE ABOVE ARE FOR SALE AT VERY LOW PRICES.

The Newark Machine Tool Works,

Newark, N. J.

BEMENT, MILES & CO.,

PHILADELPHIA, PA.

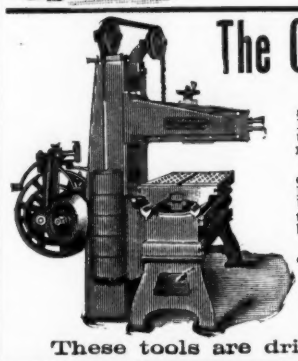
—BUILDERS OF—

METAL-WORKING MACHINE TOOLS

FOR

Railroad Shops, Locomotive and Car Builders, Machine Shops, Rolling Mills, Steam Forges, Ship Yards, Boiler Shops, Bridge Works,

ETC. ETC.

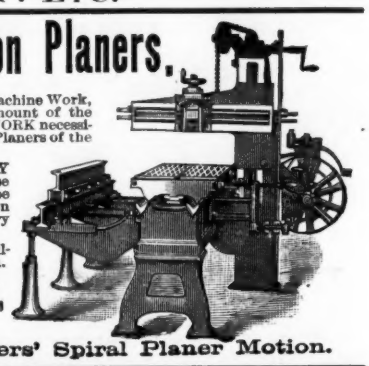


The Open Side Iron Planers.

Adapted for all classes of Machine Work, and especially for a large amount of the EXTRA WIDE and HEAVY WORK necessitating the Large and Costly Planers of the regular style.

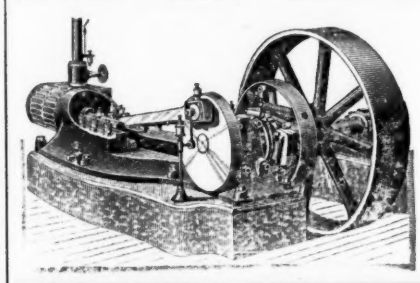
The QUALITY and QUANTITY of work performed on these Planers is GUARANTEED to be UNEXCELLED by that done on the modern tools of the very best makes

Prices, phototypes and detailed information on application.



DETRICK & HARVEY,
Baltimore, Md.

These tools are driven by the Sellers' Spiral Planer Motion.



Russell & Co.

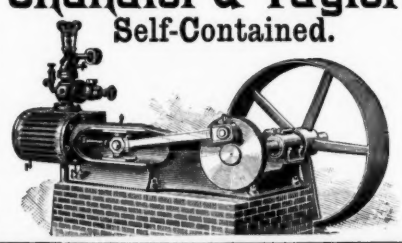
MASSILLON, OHIO,
BUILDERS OF
AUTOMATIC ENGINES
BOILERS, ETC.

Complete Power Plants Furnished and Erected.

SEND FOR CATALOGUE.

Chandler & Taylor's STEAM ENGINES

Self-Contained.

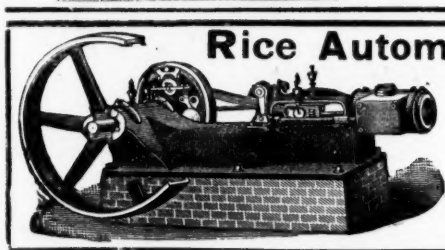


Are Strong, Well-Built and Serviceable.
Are designed for Heavy and Continuous Work.
May be run at High Speed when desired, performing the duties of High Grade Engines,
And are sold at the prices of ordinary Engines.

For Prices and Descriptive Circulars, address

CHANDLER & TAYLOR,
INDIANAPOLIS, IND.

Rice Automatic Cut-off Engine



Self-Contained. Sensitive Governor. Balanced Valve. High Speeds. Stationary Oilers. Best Economy.

Gold Medal Cincinnati Exposition, 1884.

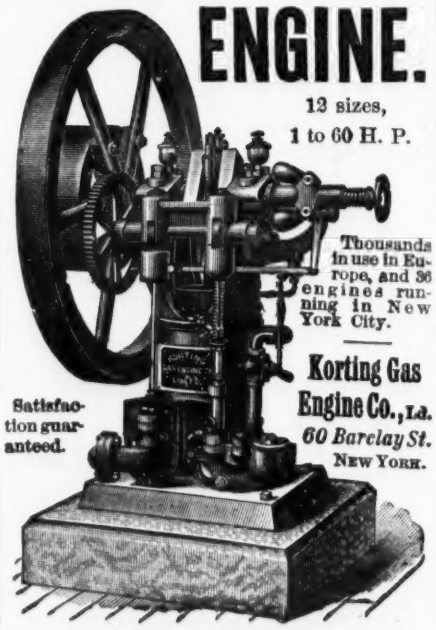
THE JOHN T. NOYE MFG. CO.,
BUFFALO, N. Y.

THE SKINNER ENGINE CO.
ERIE, PA.

PORTABLE AND STATIONARY
ENGINES and BOILERS
Send for Catalogue and Prices.

KORTING GAS ENGINE.

13 sizes,
1 to 60 H. P.



Thousands in use in Europe, and 36 engines running in New York City.

Satisfaction guaranteed.

Korting Gas Engine Co., Ld.
60 Barclay St.
NEW YORK.

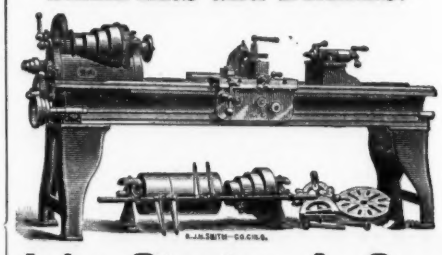
PORTER-HAMILTON ENGINE.

FOR HEAVY WORK AND LARGE POWERS.
EXTRA HEAVY DESIGN.
Send for Catalogue.

WILLIAM TOD & CO.,
YOUNGSTOWN, OHIO.

ENGINE LATHES, IRON PLANERS,

SHAPERS and DRILLS.



John Steptoe & Co.,

CINCINNATI, OHIO.

Write for cuts and prices.

BARGAIN LIST.

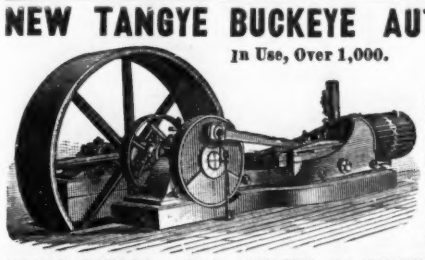
		Second Hand.
One 70 H. P. Stationary Boiler		" "
" 60 H. P. " "		" "
" 50 H. P. " "		" "
Two 40 H. P. " "		" "
One 30 H. P. Vertical "		" "
Two 15 H. P. " "		" "
One 40 H. P. Portable Engine		" "
" 30 H. P. " "		" "
" 8 H. P. " "		" "
" 60 H. P. Stationary "		" "
" 20 H. P. " "		" "
" 20 H. P. Vertical "		" "
Two 12 H. P. " "		" "
One Surface Planer, 27″ wide,		" "
" Resawing Machine,		" "
" Circular Saw Mill, 52″ Saw,		" "

New and Second Hand Shafting, Hangers, Pulleys and Belting.

S. L. HOLT & CO.,
67 SUDBURY ST., Boston, Mass.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.

In Use, Over 1,000. 25 to 1,000 H. P.



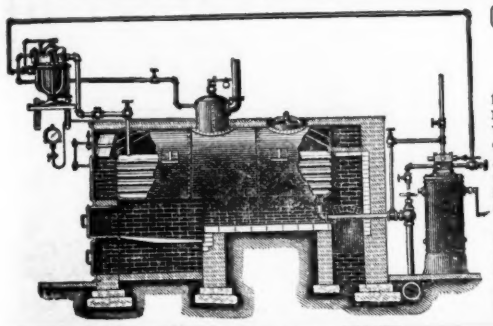
These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H P for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

SALES AGENTS: W. L. SIMPSON, 301 TELEPHONE BUILDING, 18 CORTLANDT STREET, N. Y. {N. W. ROBINSON, cor. Clinton & Jackson Sts., Chicago, Ill. {ROBINSON & CARY, St. Paul, Minn.

KENSINGTON ENGINE WORKS, LIMITED, PHILADELPHIA.

Sole Licensees and Manufacturers for New Jersey (South of Trenton), Eastern Pennsylvania, Delaware, Maryland and Virginia.

BLESSING'S WATER CIRCULATOR AND PURIFIER



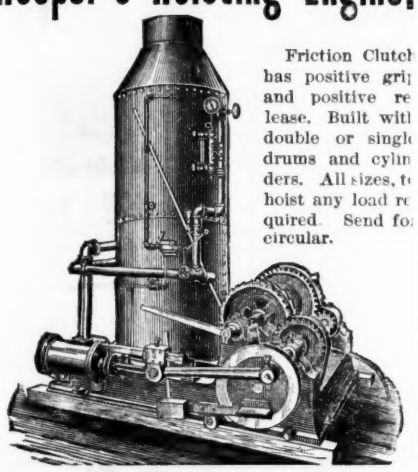
Guaranteed to Absolutely Prevent Formation of Scale in Steam Boilers.

Automatically takes water from the boiler, filters it, and returns it in pure condition, thus removing scale-making impurities from the water, and maintaining a free and steady circulation. Combines the well-known Albany Steam Trap with a Filter of novel construction, which has no rival in point of simplicity, facility for cleaning, and assurance against clogging of sand valve.

Send also for Circulars of Albany Steam Traps, Blessing's Renewable-Seat Stop and Check Valves, Pump Governors, Water Circulators and Purifiers, etc.

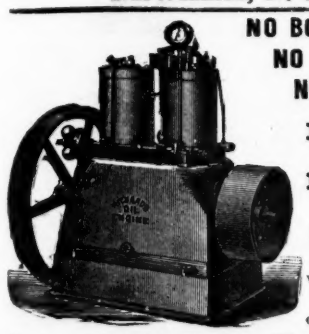
Albany Steam Trap Co., ALBANY, N. Y.

Hooper's Hoisting Engine.



Friction Clutch has positive grip and positive release. Built with double or single drums and cylinders. All sizes, to hoist any load required. Send for circular.

BUILT BY **ALEXANDER TRAUD,**
East Ferry Street Iron Works
NEWARK, N. J.



NO BOILER.
NO STEAM.
NO DANGER.

FUEL, CRUDE PETROLEUM OR KEROSENE.

Started instantly with a match.

Cheaper than all others.

Adams & Richards Machine Co.,
New Brunswick, N. J.

MACHINE TOOLS.

NEW AND SECOND-HAND, ON HAND.

12 in.x6 ft.	Engine Lathe,		ne
13 in.x8 ft.	"	Ames,	"
14 in.x8 ft.	"	Blaisdell,	"
16 in.x8-8-10 & 12 ft.	"	Bridgeport,	new.
16 in.x6	"	Blaisdell,	"
18 in.x8 ft.	"	Blaisdell,	"
19 in.x14 ft.	"	Pond,	nearly new.
20 in.x10 & 12 ft.	"	Ames,	new.
24 in.x10 14 & 20ft.	"	Ames,	"
23 in.x- 12 & 14 1-2 ft.	"	Bridgeport,	"
24 in.x16 ft.	"	New Haven,	good order.
30 in.x14 ft.	"	W and L. pattern,	new.
28 in. raised to 32 in.x16 ft.	Engine Lathe,	Ames,	"
54 in.x30 ft.	Engine Lathe,	Niles,	good as new
16 in.x42 in.	Planer	Bridgeport,	new.
22 in.x4 ft,	"	Pease,	new.
22 in.x6 ft.	"	Powell,	"
22 in.x6 ft.	"	Hendey,	new.
26 in.x5 ft.	"	Biglow,	good.
26 in.x7 ft.	"	Brettell,	new.
30 in.x7 ft	"	New Haven,	fair.
30 in.x8 ft.	"	Hewes & Phillips,	new.
30 in.x10 ft.	"	Powell.	
12 in. Shaper,		Traveling Head,	new.
12 in.	"	Hewes & Phillips,	
13 in. Stroke, 9 ft. Bed, Trav.		Head Shaper, Barr,	A 1.
24 in. Shaper,		Bridgeport,	new.
24 in.	"	Wolcott,	"
32 in. Drill,		Bickford,	A 1.
30 in.	"	Prentice,	"
16-18-2 -23-25-28-34 in. Drills.		30 in. Radial Drill.	
13 in. Stroke Slotter		H. & P.	new.
Center Bolt Cutter,			new.
50 in. Boring and Turning Mill.			A 1.
5 in. Cutting Off Machine.			Star.
Merrill Drops, 800 lbs.			good order.
Bement 2250 lb. Steam Hammer.			

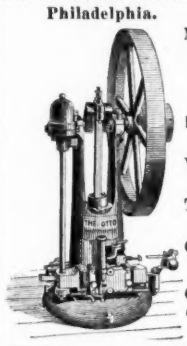
Milling Machines, Screw Machines, Slate Sensitive Drills, Gang Drills, and full line of all kinds of Machine Tools. Send for list and specify what is wanted.

E. P. BULLARD,
72 Warren Street and 62 College Place, New York.

"OTTO" GAS ENGINE WORKS.

SCHLEICHER, SCHUMM & CO.,
33d & Walnut Streets, Philadelphia. 130 Washington Street, Chicago.
New York Agency, 18 Vesey St.

OVER 25,000 ENGINES SOLD.



HORIZONTAL "Otto" Gas Engines.
VERTICAL "Otto" Gas Engines.
TWIN CYLINDER "Otto" Gas Engines.
COMBINED "Otto" Gas Engines and Pumps.
COMBINED "Otto" Gas Engines and Dynamos.

Consume 25 to 75 Per Cent. Less Gas than ANY other Gas Engine doing the same work.

FRICTION CLUTCH PULLEYS,

HOISTING ENGINES, ELEVATORS, STEAM AND BELT POWER.

D. FRISBIE & CO., 112 Liberty St, N. Y.

To Buyers of Engine Lathes

We are now making from entirely new designs, *extra heavy* 17", 19", 21", 24" and 27" Engine Lathes (the most popular sizes), of which we are making a specialty, and manufacturing in lots of not less than 100 at a time.

We make no charge for extras. Every lathe is furnished with *hollow spindle*, the 19" with 1⅝" hole, and 21' with 1⅞" hole. Every lathe has substantial *compound rest*, heavy tool post (bar steel), rest to turn full swing, *following rest* with adjustable jaws to take any size from 2¼' down, with extra tool for shafting. Full set of gears to cut from 2 to 18 threads including 11½ pipe thread. *Automatic stop on carriage. Separate screw and rod feed*, and the most substantial and easily managed *taper attachment* made. Cones and gears of large diameter and wide belt. Studs, screws and small gears are *steel or gunmetal*. Webbed live heads, heavy tail stocks. No worm or worm gears, no weak reverse plate. *Perfect lubrication for all running parts*, including carriage.

Lead screw inside of shear, double nut (cut from solid), and taking hold of carriage directly under the line of strain. Friction counter-shaft, the most durable made. Our prices are reasonable for cash, and from which no deviation will be made. Our written guarantee accompanies every lathe.

GUARANTEE.

We guarantee this lathe to be equal in workmanship, truth, accuracy, solidity, material and finish, to the best made, and hold ourselves legally liable for this guarantee.

LODGE, DAVIS & CO.

MANUFACTURERS

Machine Tools,

159, 161, 163 and 165 EGGLESTON AVE.,
136, 138, 146, 148, 150, 152, 154 E. 6th St.

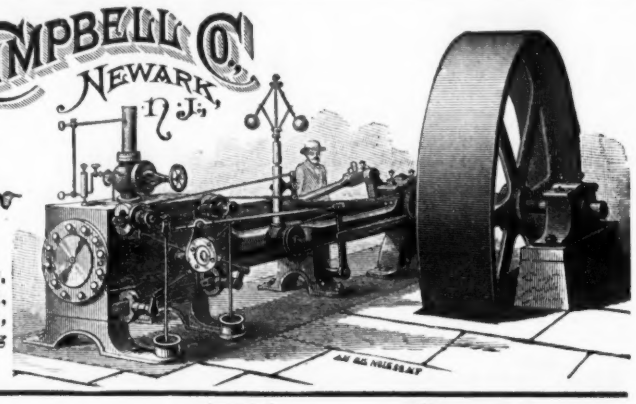
CINCINNATI, OHIO.

(See our advertisement on last page.)

The WATTS, CAMPBELL CO.

NEWARK, N. J.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.



Sizes Varying from **30 to 2000 Horse Power.**

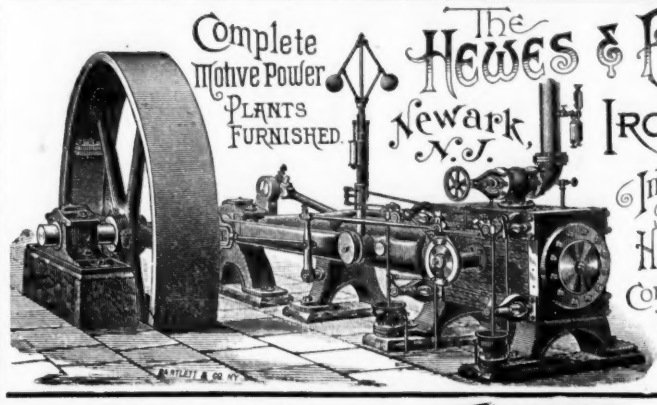
Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound.

Send for Circular.

The HEWES & PHILLIPS IRON WORKS

Newark, N.J.

Complete Motive Power Plants Furnished.



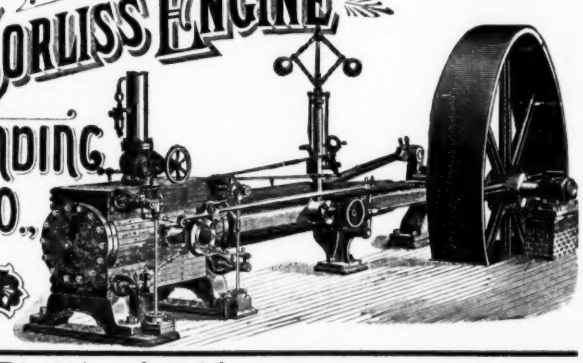
Improved CORLISS ENGINES, High Pressure. Condensing and Compound TUBULAR BOILERS.

GEO. A. BARNARD, AGENT.

THE IMPROVED FISHKILL CORLISS ENGINE

BUILT BY THE FISHKILL LANDING MACHINE CO.,

FISHKILL ON THE HUDSON, N.Y.

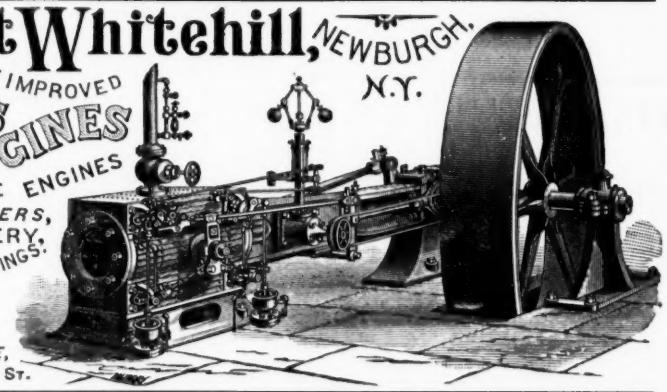


Robert Whitehill, NEWBURGH, N.Y.

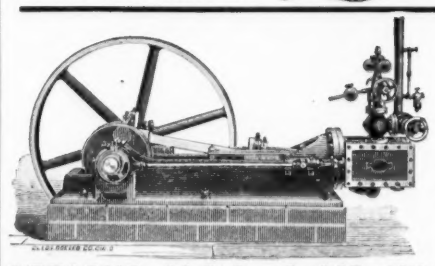
MANUFACTURER OF IMPROVED CORLISS ENGINES

ALSO SLIDE VALVE ENGINES

STATIONARY BOILERS, GENERAL MACHINERY, IRON AND BRASS CASTINGS.



NEW YORK OFFICE
Room 6,
COAL AND IRON EXCHANGE,
COR. CORTLANDT & CHURCH ST.



STEARNS M'F'G. COMPANY,

ERIE, PA.

ENGINES from 15 to 400 Horse Power.

Boilers of Steel and Iron supplied to the trade or the user. Send for Catalogues.

SAW MILLS and GENERAL MACHINERY.

Works at ERIE, PA.

New York Store, 40 Cortlandt Street,

SMITH & BARNHURST, - - - MANAGERS.

Having enlarged our Foundry and otherwise added to our facilities, we are prepared to execute orders for castings weighing from a few pounds to *forty tons*. Our Boring and Turning Mill is one of the largest in the United States, by which we can bore and turn a wheel or cylinder up to 30 feet in diameter, and we can plane 30 feet long by almost any width. With our *unsurpassed* means for handling heavy work, and shipping *by boat or rail*, we are enabled to

OFFER INDUCEMENTS

to customers.

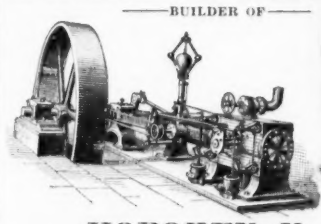
We make a specialty of machinery for making Sugar, and furnish everything necessary to fully equip Sugar Refineries or Plantations. Satisfaction guaranteed, and patronage solicited.

S. S. HEPWORTH & CO.,

"Glenwood Station," Yonkers, N. Y.

JOHN McLAREN,

BUILDER OF

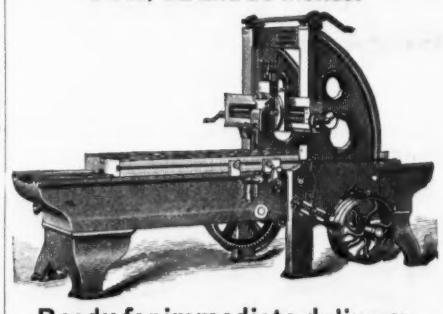


CORLISS Engines
AIR Compressors and BOILERS.

HOBOKEN, N. J.

FLATHER PLANERS

Sizes, 22 and 26 Inches.



Ready for immediate delivery.

26 in.x26 in.x6 ft.
26 in.x26 in.x8 ft.

HILL, CLARKE & CO.

36 Oliver St., Boston.

JANUARY 1, 1887.

REVISED CATALOGUES & PRICE-LISTS

OF ABOVE DATE

Now Ready and Sent by Mail on Application.

BROWN & SHARPE MFG. CO.,

MANUFACTURERS OF

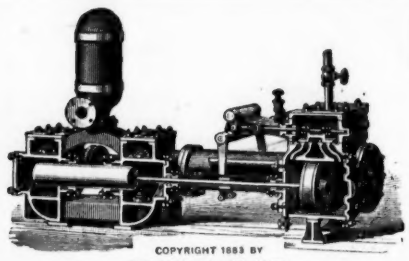
Castings, Machinery & Tools.

DARLING, BROWN & SHARPE,

MANUFACTURERS OF

U. S. Standard Rules, Cast Steel Try Squares,
Standard Wire Gauges, and Tools for Accurate Measurements.

PROVIDENCE, R. I., U. S. A.



Duplex Steam Pumps

—AND—

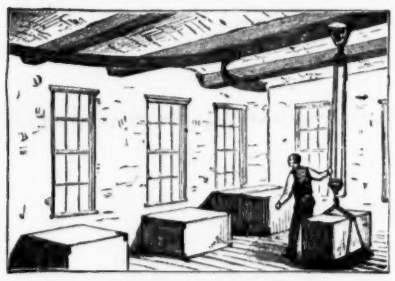
WATER WORKS MACHINERY.

THE GORDON & MAXWELL CO.

HAMILTON, OHIO.

BRANCH HOUSES:

NEW YORK, 96 Liberty Street.
PHILADELPHIA, 705 Arch Street,
CHICAGO, 96 Lake Street.



OVERHEAD TRAM-RAILS.

OVERHEAD TRAMRAILS,

—WITH—

Weston's Differential Pulley Blocks,

ANY CAPACITY.

The Weston Pulley Block is suspended from a traveler or trolley which runs freely on the lower flange of the track. The tracks, by means of curves and switches, can reach any desired points. Plans and estimates furnished on application.

SOLE MAKERS,

THE YALE & TOWNE MFG. CO., Stamford, Connecticut.

New York—Chicago—Philadelphia—Boston.

Catalogues on application.

ENGINE LATHES, SHAPERS & DRILLS.

IMPORTANT!

20-INCH LEVER DRILL.

We are now placing on the market 17″, 24″, and 27″ Engine Lathes, same design and construction as our celebrated 19″ and 21″ Lathes.

We shall produce them in large lots, in order that we may be able to offer them at the popular prices that induced the unprecedented sale of our 19″ and 21″ Lathes.

Weight of 24″ with 10 ft. bed, 5200 lbs.
Weight of 27″ with 10 ft. bed, 6500 lbs.

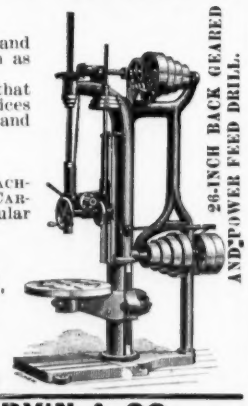
We furnish, without extra charge, Paper Attachment, Compound Rest, Automatic Stop for Carriage, Pulley Rest, etc., in addition to regular attachments.

20 in. Upright Drill.
24 " " "
26 " Back Geared.
30 " and
38 " Power Feed Drills.

LODGE, DAVIS & CO.

CINCINNATI, OHIO.

Send for Prices. It will pay you.

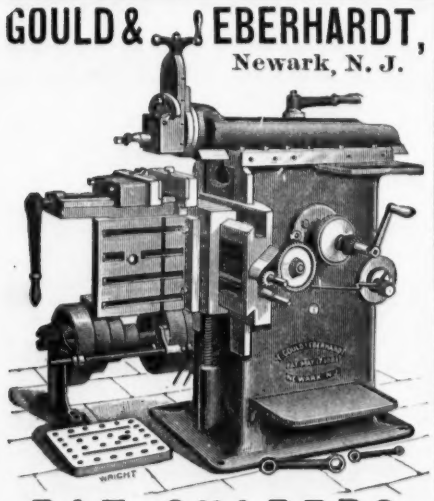


26-INCH BACK GEARED AND POWER FEED DRILL.

(See special notice of Engine Lathes on page 15.)

GOULD & EBERHARDT,

Newark, N. J.



PAT. SHAPERS.

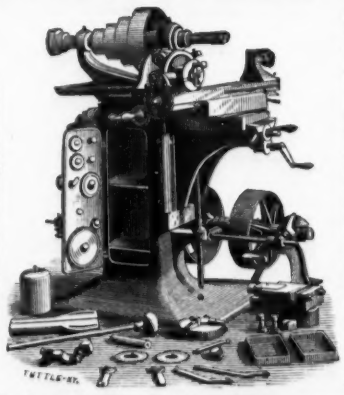
Sizes, 10″, 15″, 20″, 25″ and 30″ in stock.

NEARLY 1500 IN USE.

E. E. CARVIN & CO.,

MANUFACTURERS OF

Machinists and Iron Workers' Tools.



Universal Milling Machine.

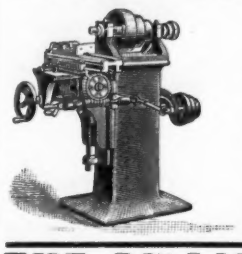
WE RECEIVED GOLD MEDAL FOR OUR NEW UNIVERSAL MILLER AT NEW ORLEANS EXHIBITION. (See cut.)

Lathes, Planers, Milling Machines and Drills. Special Tools for all kinds of manufacturing to order. Gear and Rack Cutting, Milling and Index Drilling to order.

Nos. 139 to 143 CENTRE ST., NEW YORK.

THE PRATT & WHITNEY CO.

Hartford, Conn.



Manufacture Plain Milling Machines, with hand and power feed, of several sizes. Index, double face, vertical face, double spindle and shuttle race Milling Machines. Cam Cutters and Profiling Machines of several kinds. Milling Machines, Vises and Centers. Milling Cutter and Twist Drill Grinding Machines.

RACK AND GEAR CUTTING MACHINES.

KNURLING TOOLS. CUTTERS FOR THE TEETH OF SPUR WHEELS.

THE BILLINGS & SPENCER CO., HARTFORD, CT. U. S. A.

MANUFACTURERS OF

BILLINGS' Drop Forged LATHE DOGS.

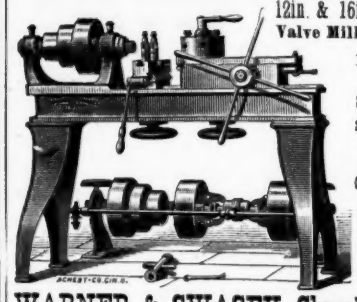
FORGED FROM THE BEST IRON AND STEEL FOR THE PURPOSE.

A Full Line in Stock.

Drop Forgings

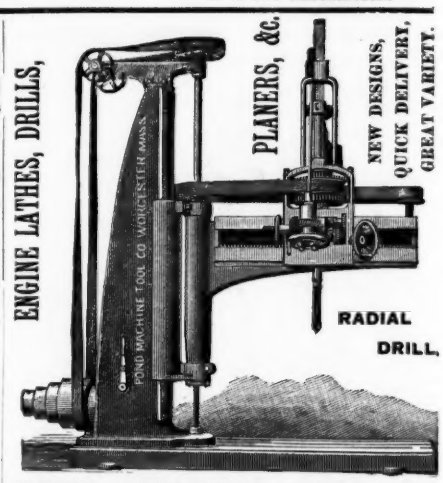
OF EVERY DESCRIPTION.

BRASS WORKING MACHINERY.



12in. & 16in. Monitors
Valve Milling Mach's
Double Key Lathes,
Speed Lathes
Slide Rests,
Revolving Chucks for Globe Valves,
Two-Jawed Chucks,
Small Tools and Fixtures.

WARNER & SWASEY. Cleveland, O.



POND MACHINE TOOL CO.

Successors to DAVID W. POND, Worcester, Mass. | MANNING, MAXWELL & MOORE, Sole Selling Agts., 111 Liberty St., N.Y.

GEO. W. FIFIELD,

MANUFACTURER OF

ENGINE LATHES

FROM 16 TO 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

Gear Wheels and Gear Cutting.—I make g to order, or cut teeth on g blanks sent to me. Of all kinds. Of all sizes to six ft. dm. Small orders or large ones. Fine g or cheap g. Small cast g. Ready made brass g by mail at low prices. Bevel g with perfect planed teeth. Hand Book on g, $1. Facilities complete. Terms reasonable. Send for cat. GEO. B. GRANT, 66 Beverly St., Boston, Mass.

KEY SEATING MACHINES

AND

20 in. Drills a specialty.

Our 20 in. Drill is a heavy substantial tool, made for service, has steel shafts and spindle. Gears and racks cut from the solid and have all modern improvements, are made by special machinery, and sold very low.

Our Key Seating Machine will save enough in 60 days' use to pay first cost; no shop can afford to do without one. We have now ready for prompt shipment, both Key Seat Machines and 20 in. Drills. Send for Photo. and Catalogue.

W. P. DAVIS, North Bloomfield, N. Y.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

HARTFORD, CONN.

J. M. ALLEN, President.

W. B. FRANKLIN, Vice-President.

J. B. Pierce, Secretary.

LATHES FOR TOOL ROOMS, &c.

FOR PROMPT DELIVERY.

17″ and 20″ Lathes, with or without taper attachments. Photos and prices on application.

THE G. A. GRAY CO.,

477, 479, 481 Sycamore Street, Cor. of Webster.

STEEL CASTINGS.

PRATT & LETCHWORTH,

PROPRIETORS

Buffalo Steel Foundry,

BUFFALO, N. Y.

PUNCHING PRESSES, DIES,

And other Tools for the Manufacture of all kinds of

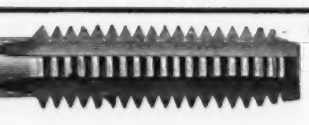
SHEET METAL GOODS, DROP FORGINGS, —ETC.— DROP HAMMERS.

STILES & PARKER PRESS CO.

MIDDLETOWN, CONN.

Branch Office and Factory 203, 205, and 207 CENTER STREET, NEW YORK.

J.M. CARPENTER PAWTUCKET, R.I.



Manufacturer —of— TAPS & DIES